THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

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LOCAL AUTHORITIES AND DEPRECIATION.

DEALING with the subject of depreciation with special reference to the accounts of local authorities, from a scientific, and not from a political point of view, Prof. Lawrence R. Dicksee, M.Com., F.C.A., has made a valuable contribution to the controversy in his recent lecture to the Chartered Accountant Student Society, of London. It may not convert the "man convinced against his will who remains an unbeliever still," but the author supports the case of provision for depreciation by arguments which may assist the inquiring public and strengthen the position of accountants employed by local authorities in insisting upon correct book-keeping, even at the sacrifice of the relief of rates. He lays down as a root principle that "in its essence an account ought always to be capable of being resolved into an account of receipts and payments in money, and would in all cases so resolve itself, if we were content to wait for an account until the undertaking had been brought to an end."

The Professor's definition of "Depreciation" is the loss or shrinkage in value which inevitably occurs in the assets which represent the capital equipment of a business, as a result of their employment therein, such loss being attributable to wear and tear, lapse of time, to the march of modern invention, or any or all of these causes combined; and he properly considers that these assets must be regarded as a working expense of the business, from which it follows that revenue should be charged with this depreciation The apologist for the system of considering the sinking fund as providing for depreciation is effectively disposed of by the remark that the amount so set aside will not be available for the renewal of these assets, "for it will have to be employed in the repayment of loans, and *the same money cannot be spent upon two purposes at the same time*" (the italics are ours), "and when," continues the Professor, "the original loan has been paid off, the local authority can obtain power to borrow further moneys for such renewals as may then be necessary, thus restoring the *status quo*."

If this course be followed, and we think that, in most cases, this is really what is done, the current earnings are not applied to the provision of depreciation, nor is any contribution made under the sinking fund. The rule of the Local Government Board, Prof. Dicksee points out, is that, whenever the renewal of an asset takes place, and provision has not been made for the repayment of the *whole* of the original cost thereof, a new loan will only be sanctioned to the extent to which provision has been actually made for such repayment.

"Taking the generally received basis of working life of, say, accumulators, tools, &c., as 10½ years, it is clear that at the end of that time they must be renewed. How can this be done by a sinking fund under the 2¾ per cent. tables, say, of about 1 per cent. for repayment of the original capital at the end of 48¾ years, when, at the end of 10 years, the sinking fund will only have amounted to 11·33 per cent., necessitating in the case of the plant in question a charge against revenue at the end of the 10 years of 88·67 per cent?"

Prof. Dicksee sums up the problem very decisively when he says: "It cannot be said with even approximate accuracy that in practice the statutory provisions with regard to sinking fund adequately solve the depreciation problem." The *modus operandi* for arriving at the proper provision for depreciation is not attained by any rough and ready process, although for practical purposes some general agreement as to the normal life of the plant may form a basis. Thus we find that for many classes of plant there is a consensus of opinion as to the useful life, such as an annual depreciation of 1 per cent. on buildings, 2½ per cent. on mains, 10 per cent. on accumulators, 5 per cent. to 7½ per cent. on machinery, &c., but circumstances so completely alter cases, that although 4 per cent. to 5 per cent. is very often taken as a fair average, it cannot be accepted as anything more than approximate.

There are two items which cannot be estimated, viz., "contingencies" and "antiquation," which upset many a promising prospect of profits, although generally affecting the capital rather than the revenue account. For instance, defective buildings requiring abnormal repairs, serious breakdowns of machinery, are accidents which belong to the category of "contingencies," and not less important in baffling calculations of results are the constant improvements in systems and plant, rendering the original plant obsolete, which constitute the item of "antiquation." This is what Prof. Dicksee calls the "march of modern invention," which it is impossible to provide for by any tabular estimates, and it seems to point to the necessity of frequent interim accounts, in order to provide in advance for meeting the altered circumstances.

Until the public grasps these principles, it will not understand the electricity supply accounts of local authorities, and will accept, as a matter of course, the payment of an amount in relief of rates as proof of the prosperity of the undertaking. The number of ratepayers who even take the trouble to look into the accounts of their district is infinitely small; a penny put on or taken off the rates excites their interest, but the details of the system of accountancy or audit only trouble the few, and hence the necessity for some grandmotherly legislation to protect those who are too indifferent, indolent or incompetent, to look into the public accounts, although these affect their own pockets. The local authorities must be persuaded or compelled to adopt sound methods of accountancy when they embark in such municipal trading ventures as the supply of electricity.

Prof. Dicksee gives an instance of the efforts he has made in the way of persuasion. This part of his lecture is of especial interest, and we quote it fully, as it contains the gist of his case. After alluding to the practice of the Local Government Board not to allow moneys to be borrowed for renewal purposes to an extent exceeding the provisions already made for the repayment of that portion of the loan, he goes on to say:—"We cannot even go the length of saying 'It will be all right a hundred years hence,' for, in one way or another—that is to say, either in lump sums as renewals take place, or reasonably equitably apportioned over the various years, if due provision be made for the contingency in advance—the cost of those renewals for which no borrowing is permitted *will have to be* borne by revenue; and, inasmuch as there is a further rule that borrowing is not allowed (save within somewhat narrow limits) in respect of expenditure that has already been incurred, it is not even possible to get straight later on, when the original loan period expires. Thus, in any event, the statutory sinking fund will not suffice to keep the undertaking going. Further charges *must* be made against revenue, as representing part of the cost of renewal of what we may, for convenience, call the 'short-lived' assets. And thus, in spite of its avowed policy to merely maintain the *status quo*, the Local Government Board in practice requires local authorities to accumulate a certain amount of capital on their own account. This is, and must in all cases be, the inevitable result of an equated loan period. That being so, the only prudent course, it seems to me, is for each local authority to have a careful calculation made, and as a result thereof, to compute the annual sum that it ought to charge against revenue, in addition to sinking fund, in order to equalise the expenditure that will necessarily be incurred on the renewal of these 'short-lived' assets. Such a charge is sanctioned by the statutory provision usually obtaining, permitting the local authority to create a 'reserve fund'—not (usually) exceeding one-tenth of its aggregate capital expenditure for the time being. This limit, although no doubt fixed without any previous scientific inquiry, will, I think, be found adequate under all normal circumstances; but the so-called reserve fund—or, as I prefer to call it, 'reserve (for renewals) fund'—should be built up systematically upon a basis computed by careful calculation, and not haphazard out of 'surplus profits,' when there are any. Then, when the necessity arises for renewals to be made for which no borrowing is permissible, the cost of such renewals may be borne by the fund, thus reducing it, and permitting further accumulations to be made out of revenue from time to time.

"This plan has already been adopted at my suggestion by the electric lighting department of one local authority, and its advantages are, I think, sufficiently evident to encourage the hope that others will gradually fall into line, and adopt the same course."

The shortest remedy would be to constitute a Government audit with a statutory provision for depreciation, as in the forms of account provided by the Board of Trade for private undertakers under provisional orders.

Tramcar Lifeguards.

An attack was made recently by a popular monthly on the whole of the "street railway" companies of North America. The article in question accused the companies of a callous and parsimonious neglect to provide the usual and necessary life-saving appliances, at the same time pointing to European, and in particular to English, practice, as an example how things ought to be done.

We believe that the majority of American cars are equipped with folding "fenders" of various makes, but on generally similar lines. These fenders project several feet from the leading end of the car, and are intended to pick up persons before they are knocked down by the car itself. Our lifeguards, on the contrary, act only after a body has passed under the platform.

The trigger guard has the advantage over the platform fender, that it is automatic, while the action of the latter depends on the driver; but the *Street Railway Journal* considers that the comparatively low mortality in Europe, and especially in England, which is thrown by the magazine in the face of the American tramways, is due not to the greater humanity of the Europeans, but to the lower speeds and the better paving.

Unfortunately the defence is weakened by misleading statements about European speeds and guards. Undoubtedly the English average speed does not approach the American, and for very good reasons probably never will, but the suggestion that our cars run only a little faster than horse-cars is liable to produce the impression that the maximum speeds are little higher; and it is quite opposed to the truth to say that the European "wheel guard" is a crude affair, somewhat similar to that formerly used on cable cars in the States, though ample for the speeds prevailing. We can assure the editor of the *Journal* that the great majority of the cars running in Great Britain to-day have an automatic lifeguard under each platform, which is capable of picking up unharmed, as one did a few weeks ago, a sledge with three boys on it. The exceptions to this rule are found in Liverpool, and, perhaps, a few other towns where special forms of guards—not mere wheel guards—are in use.

The impression that life is held rather more lightly in many well-populated parts of America than in other civilised countries has gained a strong hold throughout Europe, and it has been brought about mostly through the heavy annual crop of traffic accidents; but we do not doubt for one moment that the street railway companies over there are just as anxious to avoid personal accidents as we are, and it would be the height of impertinent self-righteousness to suggest that we have keener instincts of humanity; however, the fact remains that the percentage of fatal accidents on, or by, public vehicles of every kind in England sets a pattern to the world, not excluding North America.

PUBLICITY ANOTHER POINT OF VIEW.

[COMMUNICATED.]

So much has been written recently on the subject of publicity in connection with the distribution of electricity and the sale of small current-consuming devices, that it is difficult to say anything new from this point of view. An excellent series of articles has appeared in this journal, and other English journals have dealt more or less seriously with the same topic, whilst in America they have advanced beyond the talking point, and are actively engaged in the doing. In this country the next move is with the electricity undertakers. These extremely conservative bodies have been told what to do in order to save their undertakings from stagnation (if nothing worse). They are now believed to be debating how they may best achieve the desired end by paying the minimum of remuneration, and retaining the maximum of dignity.

It may, therefore, be of interest at the present moment to deal with another phase of publicity—namely, the work which it is necessary for the manufacturer to do in order to bring his goods before the notice of buyers, and the efforts which he must adopt in order to convert the non-buyer into a buyer.

Most of the large electrical manufacturers now possess a publicity department of a sort. But it is unfortunately true that most of them have been forced to create this department against their desires, and they generally treat it in a manner which is entirely wrong, and against all recognised business principles. A Publicity Department is usually arrived at in the following manner:—Literature has to be published, and the work is first of all done by anybody in the respective selling departments who has the necessary time (and too often by those who have not). As the business increases, it soon becomes apparent that the necessary literature is never ready at the psychological moment; that the type of each publication differs in style and face; that the blocks are not homogeneous: and that the literature does not get sent out promptly or efficiently. By the time these defects are recognised, someone is appointed to centralise this work and to organise a Publicity Department. The average manufacturing firm with a Publicity Department often makes some or all of the following mistakes:—

1. The manager is underpaid. He is, therefore, either incompetent or dissatisfied. A salary of from £150 to £200 will not find or retain a *gentleman* who must have real literary abilities, imagination, engineering knowledge and commercial instincts.

2. The manager is not allowed to carry out all the functions attached to his office. This is either through inability to recognise its potentialities, or from a desire that he should not become too important. The latter feeling is very prevalent in this country, and is generally dominant where the administration is in the hands of weak men.

3. The Department is starved. The manager is expected to do all the work with the aid of a typist and an office boy. He has no time to think, and becomes an artificer in scissors and paste. He has to produce cheap literature, and his advertising expenses are kept inefficiently low.

4. When the firm is doing badly, the Publicity Department is cut down. When the shops are full of orders, it is allowed to indulge in all sorts of extravagancies.

5. The manager is not recognised as an expert at his work, but has to submit his work to the futile criticism of Philistines, who are either eaten up with an exaggerated idea of the dignity of the firm, or else encourage the insertion of advertisements teeming with vulgarities.

6. When the Publicity Department has been organised and its routine work is running automatically, the manager is dispensed with in favour of a cheaper man. It is not understood that its success depends on a capable guiding spirit, to continually think out new ideas and to modify the department's method to current requirements.

If, by now, the embryonic Publicity Department manager has not been frightened from any desire to enter this sphere (or perhaps a full-blown one may have recognised his own experiences), he will be interested to acquire some hints as to how a Publicity Department may be carried on, with the hope that possibly his future employers may read these notes and take their lessons to heart.

The object of a Publicity Department is very often lost sight of. It is to bring the firm's manufactures before the notice of every potential buyer in the most efficient manner, with the object of converting him into an actual buyer; and when this has been consummated, to retain him amongst the firm's customers at all costs. For this reason, the first duty of the manager must be to get together a proper mailing list, and the second one to provide suitable literature. It is of no use having literature if it is not sent out; whilst it is almost as bad to send it out in an inefficient manner. We will first discuss the mailing list. In order to produce this, there are several mediums usually available. The names of persons in the firm's sold ledgers will serve as a nucleus, but it must be remembered that these are names of buyers whose custom has already been obtained. They must be supplemented by lists of names provided by the travellers employed by the various branches or agencies (if this is possible). It is necessary to make this reservation, as the manager of a Publicity Department will find that it is a very difficult matter for him to get help from any other department. He must remember that everyone else has his own special duties to perform, and any assistance of the kind indicated can generally only be given out of standard office hours. Again, many travellers will object to give away a list of their *clientèle*, thinking, naturally, that this will subsequently be used to their disadvantage. In short, everyone will be only too happy to reap all the benefits they can derive from the Publicity Department, whilst they will not be at all anxious to give it any assistance. It will be all take and no give. Let us assume, however, that it is possible to obtain lists of sorts. The next thing to do is to purchase the most recent trade directories. With the help of these and of the lists of names extracted from the ledgers, &c., a mailing list can be built up. There are two ways of doing this, but, of course, it will be assumed that the card index system will be used, as the ledger system is antiquated and quite inelastic.

The arrangement of the cards is a matter that requires some thought, and the manager must be guided largely by the methods and customs of his employers in doing business. The cards should be printed in such a manner that there is ample room for the name and address at top, and columns should be provided where the titles or numbers of the catalogues, and the dates of dispatch can be entered. The cards may be printed with these columns on both sides, or else the back may be reserved for periodical endorsement by the counting-house as to the amount of orders, if any, received from the customer. If such periodical examination of the cards can be made, this is a great help, as will be explained subsequently.

As to the arrangement of the cards in the drawers, one or more drawers should be reserved for each branch or depôt district into which, presumably, the company's business in the United Kingdom or elsewhere may be split up, should all the country be worked from one office; it is nevertheless convenient to allocate separate districts (determined by arbitrary geographical boundaries) to separate drawers. Now in the drawers the cards should be arranged according to trades and professions, all those cards under one heading being in alphabetical order of names, and all the trade sections being separated by clearly marked guide cards. It is easy, then, to pick out all the names of any one trade in any or all of the districts, should it be required to give attention to this particular class of persons. It may, however, be found more convenient to allocate a separate trade to each drawer, dividing the latter up into separate districts, but the net result is about the same.

Now, it will be seen that if a periodical endorsement of the cards can be made by the Accountant's Department, or better still, if a press copy of each order received be sent to the Publicity Department, the drawers (and therefore cards) can be divided into two most useful main sections—namely, customers and non-customers. This would, of course, necessitate a duplicate set of drawers, but as soon as a card in the non-customers' division is endorsed with an order, it can be transferred to the equivalent section in the customers' division. Whilst customers will then have the normal attention paid to them in the matter of literature, non-customers can be worried by abnormal attention both by dispatch of literature and calls by travellers. Once a year, say, the customers' cards may be examined, and a special note

taken of those who have not sent a reasonable number of orders, with a view to further action. Other methods of dealing with the cards may suggest themselves according to the methods of the firm, as already stated, but the foregoing remarks will serve as a general guide.

An important factor in connection with the upkeep of an efficient mailing list is that arrangements should be made for automatically checking the names from time to time. The lists, or duplicates of them, should be sent to the branches or agents periodically for them to look through, in order that liquidations, deaths or removals may be duly noted, and new names added; also, the branches should send to the Publicity Department all information of this sort that they may acquire during the course of business, and they should make weekly or monthly reports tabulating particulars of the publications, that have been handed to customers and others, so that this information may be noted on the cards. In the case of isolated dispatches of publications, this work can be done by hand, but when new literature is sent out in bulk, it is better to use an indiarubber stamp in order to save time. The stamp should be made to fit the space available on the cards, and a suitable supply of rubber type should be kept. Suppose then that catalogue No. 10 is dispatched to certain classes of buyers, it is quite sufficient to fit the stamp with the number "10," and with the date, say, "13/7/07," so that these figures come in the columns headed "publication" and "date" respectively. If a larger quantity of literature is sent out, so that there is not room to enter it in detail on the card, a reference letter may be stamped instead, and a key-book kept for the purpose. In fact, it is a very good plan to do this in all cases of bulk distribution, entering in the key-book under the reference letter the date, nature of publications, classes of persons to whom sent, and quantity to each district.

(*To be concluded.*)

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Cost of Living in South Africa.

It is very gratifying to the writer of the article on the above subject to find that it has proved of sufficient interest to inspire a letter—presumably from South Africa—signed by "E. E. H.," which appears in your issue of April 19th. It is also pleasing to note that the statements in the article are by this gentleman admitted to be "quite reliable." Based, as they were, on six years' residence in South Africa, which residence ranged between Cape Town and Beira, it may be fairly claimed that they at least ought to have been so.

First, allow the writer to say that the article was intended for those engineers who may be contemplating a journey to South Africa in order to improve their positions in life, and not for those people who are already in the country. An endeavour was made in the article to avoid all unnecessary trivialities, and merely to place before such intending emigrants, in this country, a few cardinal facts from which their own deductions might be made. For instance, if the average receipts and expenses of life of a "superior artisan" or "locomotive driver" are given, it should not be impossible to ascertain approximately what the corresponding figures should be when applied to a resident engineer, &c. Moreover, in relation to Cape Town, an equivalent was made by mentioning that the cost of living indicated would about equal that obtainable in London for £6 per month.

It is unfortunate that the criticism by "E. E. H." deals mainly with what might have been said in the article, instead of that which was actually stated. There would have been no difficulty in writing an article of five or six columns on the subject; the difficulty was rather to deal with the matter at all comprehensively in less than two columns.

The argument, if any, contained in paragraph four of "E. E. H.'s" letter is not easily discernible. The article did not say that if a certain class of living costs £6 per month in Cape Town, that amount could not be extensively increased, say at the Grand Hotel of that city.

The average cost of living in Natal *is* cheaper than that in Cape Town, and it *is* borne out by experience, if only by the writer's. He was personally, acquainted with a middle-class boarding establishment in Smith Street, Durban, where the charge for the partial use of a bedroom and three meals per day (two consisting of six or seven courses each) was £4 10s. per month. This cannot usually be obtained so cheaply in Cape Town, nor is it, it must be admitted, the rule in Durban.

Laundry bills were certainly not considered in the article; neither did it mention (nor does "E. E. H.") that owing to the smaller size of Durban one can live within easy walking distance of business quarters (impossible on the same scale in Cape Town)—thus saving tram fares for the purpose. In making this criticism, "E. E. H." has himself made a "serious omission," in that he has forgotten to mention that where washing suits are worn, the cost of cleaning starched shirts, collars and cuffs is unnecessary, as they are often, and sometimes entirely, discarded. In this connection, and especially with reference to the concluding paragraph of the letter in question, the writer would remark that when attempting to split hairs one should be careful to do it thoroughly.

The Writer of the Article.

Braking Operations for Tramcars.

I should like to say a word or two in reference to the article on p. 628, and also your editorial in the current issue of your paper on brakes for tramcars.

As you know, I am interested in this subject, but, through a different course of experience, I have evidently arrived at conclusions different to those expressed by yourselves on the method of braking a car.

At the present time the method you refer to as "A new emergency brake" is, except to a favoured few, clouded in mystery; but the results given are not by any means new, as I have no doubt just as good results can be obtained by other brakes that do not lock the wheels of a car. There is one thing, however, very new in the last paragraph of the article, where it is stated, "All the tests helped to prove that a car could not be overturned if the brake was applied before the moment of the disaster had arrived." Did the tramway company allow of a test on any curve to demonstrate that moment?

I have a very distinct objection to the brake mentioned. It is merely an emergency brake, it is not the ordinary service brake, and that being so, it is just as likely to lead to disaster as any other emergency brake, although it is only necessary to touch the button to make it operate. It is always "only" the failure of the driver to do the right thing at the right moment which brings disaster.

We have to provide for the man who is likely to lose his head in an emergency, and I contend that, for a brake to prevent the possibility of such an occurrence, the brake which is to be used in cases of emergency must necessarily be the ordinary service brake of the car.

There is only one method of control that can give this desirable result, and that is the regenerative system. I have had a considerable experience with that system in operation. I can now write independently and without bias regarding it, and it is the only system, in my opinion, that gives a perfect control of the car, because it acts instantly and is automatic, and there are no buttons to press and no levers to operate. On the first car ever equipped with an automatic regenerative control system, and then not so perfect as now, I have pulled a car up in 3·5 seconds, when going down a grade of 1 in 18 at 16 miles an hour. At 8 miles per hour, on the same grade, the car was pulled up in 1·4 seconds.

There is nothing better than that given in the records of the "New Emergency Brake," and the regenerative method is superior because it is done by the ordinary apparatus, only it is, on emergency, done quickly instead of by gradual service braking.

The regenerative system with automatic braking action affords absolutely the ideal method of handling a car under

all conditions, and I give concisely the following reasons for the opinion I have formed of it :—

(*a*) It is the ordinary service brake.

(*b*) It is the emergency brake.

(*c*) Both the above operations are given by the controller alone on the service notches.

(*d*) On emergency a more powerful braking effort is produced than by any other known method of braking.

(*e*) It performs these functions not by the dissipation of energy, but through the recovery of energy.

(*f*) It is more economical in braking than any other method.

(*g*) The driver can always tell at what speed the car is travelling.

(*h*) He cannot exceed the speed limit fixed for the system.

I am not writing in favour of any particular system : I am making claims for *the regenerative method of control*, that is automatic in its operation, and I consider the manufacturing companies and those interested in tramway operation owe the travelling public a debt which will not be liquidated until they take up jointly this system of control and decide to have properly designed shunt motors, so that all the advantages of safe handling, with economies thrown in, can be secured.

I sincerely hope the Tramways and Light Railways Association and the B. of T. will investigate this system of control, and give tramway managers the full benefit of their tests and trials.

It is not to the public welfare that such an excellent control as that of regeneration should be kept back because the vested interests of large and powerful companies are strong enough to override it, and I think the Board of Trade, who are supposed to have some consideration for public safety, are very much to blame for not thoroughly investigating it.

Safety in operation should be the first consideration, and absolute safety can only be secured by the system I have advocated above.

Jno. I. Hall.

Kingston-on-Thames, *April 20th*, 1907.

[We have been, and are, strong advocates of the regenerative system of control, which, indeed, is making headway ; but the vast majority of electric cars are still driven by series motors, and are likely to continue so for a long time to come. What is urgently required for these (pending their conversion to the regenerative system) is a brake of the kind that we have described.—Eds. E.R.]

Of Dogmatism in Science.

Your contributor, "W. M. M.," in your issue of April 12th, makes a sweeping charge of dogmatism against the present generation of physicists, which, if justified, cannot be too strongly condemned, and I look forward with interest to the instances that "W. M. M." promises to adduce.

Scientists are freely charged with dogmatism in the popular Press by apologists for mystic theories. These, however, frequently spoil an eloquently-supported general case by giving instances. Personally, I have never met with such an instance which could not be properly described as piffle—either founded on misapprehension of facts, or, like the example given by "W. M. M.," erected by themselves for demolition. I have not met with serious dogma in physics, unless the word is stretched to cover the productions of those who essay to be teachers of subjects of which they are not masters.

Your contributor's first example is indeed an unfortunate one. He makes the entirely gratuitous assumption that μ and κ are each unity for air, and then instances the statement that $1/\sqrt{\mu\kappa} = 3 \times 10^{10}$ as a choice specimen of scientific dogmatism. There is no mystery about the matter however, μ and κ are *not* both unity. In the electromagnetic system the units of magnetic force and magnetic induction are so chosen that $\mu = 1$ for air. κ however, that is the electric displacement per unit electric force, is far from being unity ; there is no earthly reason why it should be so. Its value can be, and has been, determined* by measuring experimentally the capacity of a condenser of such form that its capacity can be computed, so far as it depends on the dimensions, and thus expressed in terms of the specific inductive capacity κ. Thus an equation giving κ is derived, and the value found for air is approximately $1/(9 \times 10^{20})$. It is true that in the electrostatic system of units $\kappa = 1$ for air, but in this case $\mu = 1/(9 \times 10^{20})$, so that in either system of units $1/\sqrt{\mu\kappa} = 3 \times 10^{10}$. This is given explicitly by Maxwell.†

"W. M. M." is, therefore, correct in ascribing the error to the mixing of systems of units, but the error is entirely his own. No physicist in his sober senses would misinterpret the expression, as "W. M. M." has done ; for to look to the consistency of units becomes, with a little experience, a sort of instinct. Accordingly, I doubt very much whether Messrs. Lodge, Rücker & Co. would find it necessary to proffer the fantastic explanation of the matter that "W. M. M." credits them with.

If your contributor had brought this forward as an example to show the lack of grasp of the subject on the part of most of the writers of text-books he would have been amply justified, for it is very rarely treated as if it were understood by the writer. As an example of dogmatism in science, however, it is a failure.

F. W. Carter.

Rugby, *April 20th*, 1907.

I quite agree with Mr. Carter that it is an instinct to look for consistency in units : so much so that in mathematical investigations one seldom troubles to think what units underlie the equations, at least until the results have to be interpreted numerically. Nor do I suppose that any physicist ever really supposed that the velocity of light was a centimetre per second. My point is that a result due to confusion of units, a not unnatural confusion, considering that both systems are C.G.S., has been corrected, not by discovering and setting right the original misconception, but by arbitrarily changing the value of the constants μ and κ. These are both defined as unity for air, and they are so used in the original equations. I have indicated one way, I believe the simplest, in which the equations can be reconciled without change in the values of μ and κ ; but it can be done, and has been done, otherwise. On p. 293 of "Electric Wave Telegraphy," Prof. Fleming quotes the generalised equations as given by Hertz, introducing a constant $\alpha = 1/v$, in order to reduce the equations to a common system ; and the first three lines on that page, are :—

"Suppose that we limit our consideration to space occupied only by æther, *and take the permeability and dielectric constant to be unity*. Then," &c. (The italics are mine.)

Sir Arthur Rücker was, I think, the first to suggest suppressed, or unknown, dimensions for μ and κ, in the year 1889, and others have followed him blindly.

I have not Maxwell by me, and am unable to verify Mr. Carter's quotations. I will look them up when I have an opportunity ; meanwhile I hazard the opinion that either Mr. Carter has misunderstood him, or the values given for κ and μ have been added by Maxwell's editors.

It is hardly necessary to add that I have nothing in common with the "apologists for mystic theories," cited by your correspondent. You, Sir, know that I am opposed to mysticism, even when masquerading as science. Nor am I concerned here with the smaller fry of text-books ; I have had my say about them in your columns on a former occasion. As for the "fantastic explanation" with which I credit Messrs. Lodge, Rücker and Co., I should not have thought it needful to explain that it is but an exaggerated parody of the theory of suppressed dimensions to which I take exception.

One word more, though it is anticipating part of my second article on this subject. The definition of electric displacement has always seemed to me artificial, an opinion which, I find, I share with Prof. J. J. Thomson. It is quite possible that it might be so defined that κ should

* See "Maxwell's Treatise on Electricity and Magnetism," §774.

† *Idem*, §786.

be some exceedingly small quantity. But, while that definition stands, K must be unity for air, no matter what system of units be employed.

W. M. M.

Station Engineers and Contractors.

The article of "G. B. B." in your issue of April 19th, abounds with food for thought, and if electric lighting is to compete with gas, much will have to be altered in the methods of station engineers; some will do their very best to help one, while others stand behind their cast-iron rules and look on one with contempt. It is in some of these districts that the gas company is making much headway; here is an instance that will illustrate my meaning. At a job near Lancaster Gate, notice was given to the gas company that their service was cut off in the road. At 3 o'clock the same day a party of men opened the road, and by 5 o'clock the gas was on. Tell me the name of an electric supply company who would have sent to test, let alone take up the road, without "due notice," and by letter, too! Telephone barred; "we don't make appointments to test by telephone," says one company. An instance of the want of co-operation. A few weeks back, I complained at the length of time a supply company took to connect up a job near Balham; a week after the job was tested, and the light on, I was surprised to get a reply from the company, stating that my letter should have their best attention, and they hoped to connect up shortly!

Here is an instance of rules carelessly compiled. A client of mine near Chelsea wanted certain alterations made. I applied to the company for their requirements, and, as I thought, carried them out. In fact, I did more; I fixed a main switch which they had quite forgotten to mention. When their man arrived to test, nothing was right, and the job could not be connected. I went to the office and argued the point, and got them to admit that it was possible to construe their meaning as I had. Notwithstanding this, I received a letter stating that the work could not be passed until I had made certain alterations. They even wrote my client, and tried to make trouble that way, but without success. Although they will not pass my work, they have added my suggestions to the rules, which now make their requirements plain and intelligible, but, at the same time, more costly than necessary. Still, we hope for better things, and trust that engineers will come down during working hours to the level of contractors, and see with us to our common advantage.

A. F. Roffey.

London, S.W., *April 22nd*, 1907.

Thermit Welding.

With reference to the article appearing in to-day's issue of your journal regarding thermit rail welding, we are sorry to see that you are apparently under the impression that the joint has made better progress abroad, and especially in the United States, than in this country, and we think it might be of interest to your readers if we stated a few facts regarding the actual position.

Practically the same number of thermit joints have been welded in each country, viz., for the year 1906, 16,530 in the United Kingdom, against 17,715 in the United States. These numbers represent, computed at the rate of 176 joints per mile with 60-ft. rails, about 100 miles of track in each case.

Altogether about 40,000 joints have been welded in this country so far, against approximately 30,000 in the United States, the American business having been started rather later than the English. On the other hand, this company has had to remove several obstacles which, at the beginning, rather impeded its natural development.

Welding in this country last year was carried out in 28 different towns, and in 14 cases the orders were given by towns which had previous experience in welding. From the very fact of these towns having given us repeat orders, there would appear to us to be no necessity for anyone to obtain their testimony for the joint from abroad, and we believe the joint was very well spoken of indeed at the Municipal Tramway Association meeting last year.

Among the towns where the system has been used to a large extent, we may mention, in the first instance, Leeds, where since 1903—up to the end of last year—approximately 11,000 joints have been welded; Glasgow with 5,500 joints, Manchester with 2,700 joints, Nottingham with 1,500, Coventry with 1,925, and Leyton with 2,970 joints. In each of these towns, with the exception of the last two, they have carried out their own work.

There is no doubt that America has a considerably larger field for the thermit joint than is the case in this country, where new construction work has, to a great extent, been done, but we venture to suggest that as to quality of work and results, English thermit welding need fear no comparison.

We might also mention that this company has so far sold material for making about 30,000 joints to the English Colonies and possessions abroad.

For **Thermit Ltd.,**
R. Stutz, *Managing Director.*

London, E.C., *April 19th*, 1907.

Fancy Names for Lamps.

I quite agree with Mr. W. A. Topping in his complaint against so many confusing fancy names for lamps, with usually no candle-power or current stamped on them. I also read Mr. R. L. Matthews' letter, *re* "Tubolite," in your issue of April 19th, but do not quite follow his difficulty in stamping the current on his lamps, "because they are often used in series." A lamp which is made for 100 volts and stamped with that pressure, will surely take the same current and also the same watts, whether used singly on 100 volts or five in series on 500 volts.

I shall be glad if Mr. Matthews will explain.

C. W. G.

Re Patents.

I am desirous of knowing the opinion of your numerous readers as to whether it is feasible or desirable that a body or association of experts should be formed to deal with patents. It is my idea that there are hundreds of patents every year which are being re-discovered; there are also hundreds of patents which never come to the light, either because manufacturers or others are chary about taking up new inventions, or because they will not pay the inventor a royalty or outright purchase price.

I consider that if a consultative board could possibly be formed, the said board could put their seal, so to speak, on various inventions; a nominal fee could be charged in advance for inventions so submitted to them.

The inventor could then go to the manufacturer with a partial guarantee of the stability of his invention—depending, of course, on what the experts said with regard to the practicability or usefulness of the invention.

D. R. Broadbent.

Tunbridge Wells,
April 22nd, 1907.

LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.*]

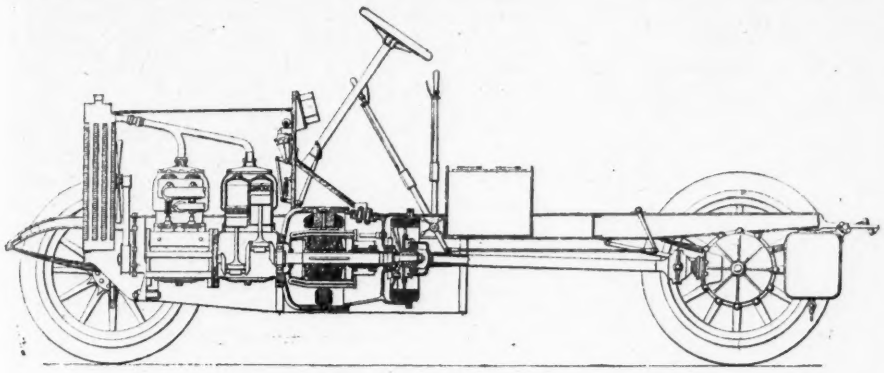
No. 86.—*Restrictive Covenant—Validity.*

"J. S." writes:—"Would you kindly let me know through your Legal Query column whether a clause in an agency agreement would be valid which prohibited the agent from representing a competitor within, say, three to six months after the agreement was terminated."

*** Such a clause would be valid. Covenants which restrict a sometime employé from entering into competition with his former employer are frequently discussed in, and have often been upheld by, the courts; the test being—Is the covenant reasonably necessary for the protection of the employer?

THE CORDINGLEY MOTOR SHOW.

The twelfth annual Cordingley Motor Show at the Agricultural Hall, London, N., was bought to a successful conclusion on Saturday the 13th inst. Notwithstanding the bad weather which prevailed, there was an excellent attendance, and so far as we can learn, the majority of the exhibitors were well satisfied with the amount of business done. This week we conclude our reference to the exhibits of interest to electrical engineers. An interesting feature of the exhibition was the display of combined petrol-electric cars in which, while the internal combustion engine is retained as the prime mover, the power is transmitted electrically instead of mechanically to the road wheels.



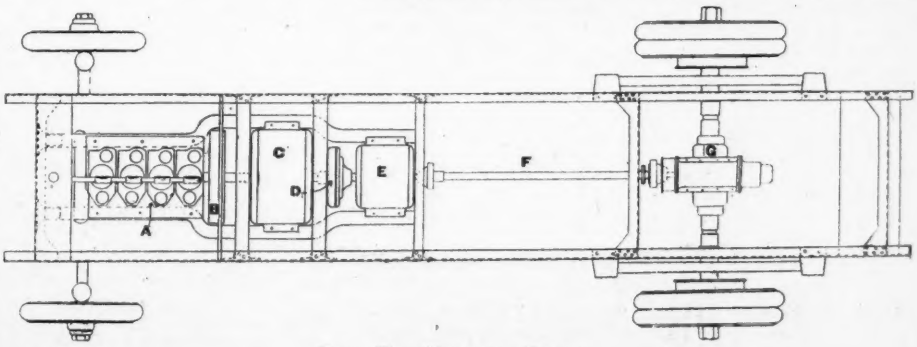
Sectional Elevation, Auto-Mixte Car.

Mercedes-Mixte Hub-Motor and Wheel.

A, Commutator; C, Brushes; F, Field coils; D, Cables; S, Axle.

Considerable interest was shown in the display of vehicles built on the Henri Pieper system by La Societe l'Auto-Mixte, of 65, London Wall, E.C., and Liége, Belgium. The vehicles in outward appearance closely resemble the standard design of petrol cars, the machines on view including an elaborately finished limousine well adapted for touring purposes. The above system was described in the Electrical Review of May 4th, 1906. The arrangement is briefly as follows: A petrol engine drives a shunt-wound dynamo keyed on to the main shaft; the dynamo works as a motor or generator, according as the E.M.F. is inferior or superior to that of the battery. In the first case it produces an excess of power; in the second it absorbs the excess power supplied by the engine. The battery is always maintained in a state of charge by the dynamo, and serves besides its rôle of reserve power, for the starting of the engine, for the clutch and brake, for ignition, lighting, and any other accessory services, such as foot-warmers, electric signals, &c. The rotary speed of the engine is limited to that imposed by the dynamo which it drives; and the latter is of the four-pole type, with series drum winding and shunt excitation, provided with auxiliary commutation poles with series excitation, which assures a good commutation. The carburetter for the engine is provided with an electro-magnetic regulator; it is of the ordinary Longuemare float-feed type, the mixture admission valve being, however, controlled automatically by the action of a soft-iron core suspended by a spring, and placed in a solenoid with two windings. One of the latter, of fine wire, is shunted across the terminals of the battery. The other winding — a series one — is placed in the circuit connecting the dynamo to the accumulators. The tension of the spring, which carries the core, is so regulated that when the accumulators are properly charged, the dynamo neither produces nor absorbs current, the petrol engine developing just the necessary power to drive the car at its regulation speed, and to keep in movement the generating plant so as to supply the small current necessary for the auxiliary services of the battery. Great advantages are claimed for the system in the way of simplicity of control, &c., and the makers state that with an equal maximum power, the chassis of the Auto-Mixte is no heavier than that of an ordinary petrol car, the weight of the parts suppressed in the latter being equal to, if not exceeding, that of the dynamo and accumulators.

The Mercedes Electric Co., of 12A, Savile Row, London, W., exhibited a 45-H.P. touring car and a 40-H.P. single-deck 34-seated 'bus on the Mercedes-Mixte system, which has been developed by the Austrian Mercedes Co., of Vienna. The prime mover in both these vehicles comprises a four-cylinder engine. In place of the clutch and gear box of the ordinary petrol car, a small dynamo is mounted on an extension of the crank shaft of the engine, the current generated being transmitted to a lever-actuated controller of the type used on electric motor-cars, and thence to two series-wound motors, built up in the hubs of the rear road wheels. The motor shell forms the wheel-hub proper, and is itself formed with a central bearing, receiving the axle upon which the road wheel rotates. Each armature is keyed to the hollow axle, through which the motor leads are taken, and secured by a nut and lock nut; while around the armature, and solid with the shell, are the fields. These rotate to turn the wheels when the current is transmitted, series fashion, to the armature; the commutator and spider on which the contact brushes are fixed being inside the hub-plate on the outer side of the wheel. This plate is secured by some half-dozen screws, the removal of which exposes the commutator and brushes, which can thus be examined in a very few minutes, if necessary. In the Mercedes-Mixte system no accumulators are used, and as the hub motors are independent of each other, another advantage accrues, in that it obviates the use of the usual differential gear, as well as all mechanical power transmission apparatus. The braking system is also interesting. The mechanical brakes, actuated respectively by a pedal and a hand-lever, are of the internal expanding and band types seen on ordinary petrol cars. It may be noted, however, that as the pedal brake comes into action, it operates a switch which cuts out the current for the time being, from the dynamo to the motors. In case of failure of the mechanical brakes, an electric brake may be immediately constituted, with the whole power of the petrol motor behind it, by simply reversing the current to the



Plan, Hart-Durtnall Chassis.

A, Motor; C, Generator; D, Clutch; E, Motor; F, Cardan Shaft; G, Differential Gear.

motors from the dynamo, by means of a reversing switch. Great hill-climbing efficiency is claimed for the system, for the engine can be run at its maximum speed, the dynamo and electric motors being designed to take this without being overloaded. The same company exhibited a four-seated electric brougham, in which the hub motors are supplied with energy in the usual way from a battery of accumulators carried under the driver's seat.

The Hart-Durtnall Syndicate, Ltd., attracted considerable attention with an exhibit of a handsomely-finished double-deck petrol-electrical 'bus, the electrical arrangement of which was outlined in our issue of February 1st. In this case the engine is coupled direct to a four-pole polyphase generator, a small 1·5-kw. series-wound continuous-current exciter and one half of a special magnetic clutch. The spindle of the other portion of this clutch passes through a polyphase induction motor, a universally-jointed or cardan shaft thence conveying the power through a worm gear drive to a rear live axle. The motor is only employed when putting the car into motion or on steep hills, for as soon as a fair rate of speed is attained the magnetic clutch engages, and the power of the engine is then transmitted direct to the rear road wheels, the generator and motor turning idle. It is claimed that the car can be driven on the direct drive, that is, without the intervention of the generator and motor, at as slow a speed as 4 to 5 miles per hour, simply by controlling the admission of gas to the engine, the electric system being only called into operation on starting or on climbing steep hills, when the load may be too great for the existing gear ratio. The engine is put in operation in the ordinary way, and as soon as the car is ready to start, the small continuous-current exciter on the generator spindle supplies an excitation current at low voltage to the alternator field windings. Polyphase current is thus generated, and transmitted through reverse and two-speed switches to the stator windings of the motor, and thence to the rear axle. As soon as the car gets away, a direct drive is obtained by placing the magnetic clutch winding in series with the field of the generator, which weakens the field, and at the same time brings the clutch gently into contact. As soon as this takes place, a bridge-piece short-circuits the generator field, and the exciter then only furnishes energy to the clutch windings, which give a firm grip and a direct drive at about 12 miles an hour. Should it be necessary to stop and restart on a steep gradient, the two-speed switch is placed in the low-speed notch. This gives increased torque at the road wheels, the engine running its maximum speed and driving the car slowly. When the vehicle is pulled up sharply, the exciter field is short-circuited before the brakes are applied, and in starting off, the exciter cannot pick up again until the driver takes his foot off the brake-pedal, and the band brakes are clear of the drums. The bridge contact then opens up the field, allowing the exciter to build it up, and the car starts again. A further feature of the system is a magnetic brake, which automatically comes into operation when descending hills. The 'bus exhibited was driven to the show from Luton *vid* Dunstable, a distance of 40 miles in just under two hours on a petrol consumption of one gallon per 6·667 miles. The system, as will be seen, is quite a new departure, and we shall watch its further development with interest.

In addition to the 2-ton electric delivery lorry referred to in our last issue, The Improved Electric Traction Co., Ltd., of Cockspur Street, London, S.W., had on view the chassis of an interesting American-built electric car suitable for use as a delivery vehicle or public service machine, inasmuch as four electric motors are provided, one to each road wheel. They are supported from the axles, the power being transmitted direct through enclosed spur gearing; the motors are each of 4 h.p., but are so designed that they are able to withstand a considerable overload. The axles of the car are of special construction, and a noteworthy feature is that the steering pivots of the front wheels pass directly through the forward motors. The electrical energy is furnished by a battery of 44 Chloride accumulators, the capacity of which on one charge is stated to be sufficient for a run of about 45 miles.

In the gallery there was the usual collection of motor-car accessory exhibits, among which were accumulators, magnetos and other specialities used in connection with the ignition in petrol motors. Messrs. J. C. Lyell & Co., Ltd., Westminster, among other articles, exhibited a novelty in the "Zulu" change-over switch, for use on cars having two systems of ignition, and enabling a change-over from the coil and accumulators to the magneto to be readily made; Messrs. Harry W. Cox, Ltd., showed induction coils of their own manufacture, and the "C. M." accumulator, the feature of which is the design of the grid and the method of connecting it up. The Prested Miner's Gas Indicating Lamp Co., Ltd., Holloway, had on view a range and their Prested accumulators, coils and sparking plugs; while The Gratze Patents and Engineering Syndicate, Ltd., were present with a range of accumulators for ignition and carriage, and a new synchronised high-tension distributor, in which the wires are stationary.

Trade of Siam.—In a recent report, the French Consul at Bangkok states that the total imports of electrical apparatus into Siam in 1905 were valued at 278,918 ticals (about £16,160); the total trade was divided as follows amongst the several supplying countries:—United Kingdom, 185,938 ticals; Germany, 34,739 ticals; United States, 19,186 ticals; Singapore, 17,797 ticals (these were probably all transhipped at Singapore); Hong Kong, 13,734 ticals; other countries, 7,524 ticals.

PARLIAMENTARY.

Great Northern and City Railway.

A Select Committee of the House of Commons, presided over by Mr. D. A. Thomas, met on Thursday, April 18th, to consider the above Bill.

Mr. E. Moon, K.C., opening the case, said the promoters sought powers for the purpose of constructing an extension of the present line in the direction of the City. It was quite a short extension, but a very important one. Incidentally they had to ask the Committee for an extension of time in order to acquire certain lands which were authorised to be purchased for the purposes of the extensions in 1902. Moorgate Street was never intended to be the ultimate termination of the line—it was always recognised that it would be necessary to extend it to Lothbury. Although the distance was only 400 yards it made all the difference in competing for traffic. This proposal was opposed by the Corporation of London in 1902 on the ground that the extension was not wanted, and that the capital could not be found. The Committee, however, at that time found that the extension was required, as did the Traffic Commission. The cost of constructing the line was estimated in 1902 at £200,000, but experience had shown them that owing to the use of compressed air, it would cost another £20,000—£220,000 in all. The company had powers to raise the necessary capital, but having regard to the condition of the money market, they had not thought fit to do so as yet. £34,000 had already been spent in connection with the extension, including the underpinning of a part of the Bank of England, so there could be no pretence for saying that the company did not intend to go on with the work. The only opponents to the scheme were the Corporation, and he supposed they were coming to say, as they did in 1902, that they could not raise the necessary capital. Times, however, were improving, and there was no doubt that, as soon as the condition of the money market warranted it, they would be able to raise the capital, and proceed with the extension. Nobody had been harmed by the delay, and a further extension of time for another three years could not damage anybody.

Sir Douglas Fox, chief consulting engineer to the company, said that the extension would be a full size 16-ft. tube railway. They carried 16 million passengers last year. Preliminary works in connection with the extension had been carried out. They had also constructed their generating station of such a size as to deal with the extension.

Evidence in support of Counsel's opening statement was then called.

On Friday, April 19th, Sir R. Littler, on behalf of the City Corporation, called Mr. A. C. Morton, M.P., chairman of the Streets Committee. He said that in 1902 the Streets Committee considered the matter, and came to the conclusion that the railway should not be extended beyond Moorgate Street in consequence of the difficulty of managing the City traffic. They thought there would be less need for the extension when the Northern tramways of the London County Council were electrified.

Your position is that it is better to have these stations on the radius of a small circle rather than to bring everybody to the Bank or the Royal Exchange?—I have come to the conclusion that it is absolutely necessary to assist the police in managing the traffic.

Further examined, Witness said the Streets Committee were opposed to having more than two tubes in any of these streets, in consequence of the danger to property.

Sir Ralph Littler then addressed the Committee on behalf of the City Corporation. He said that the Corporation viewed the proposal of the railway company to construct this line with great anxiety. The Corporation were opposed to the running of trams within their area on the ground of danger to life and impediment to traffic, and Parliament had always supported their views. They always endeavoured to assist the public with their means of getting access to and from the City, and he mentioned that the Corporation were spending over a quarter of a million in widening Blackfriars Bridge, so as to allow the trams to pass over the bridge. He did not think the proposed line was of any practical use. They had been told before how profitable these underground tubes were, but what was the fate of the Inner Circle? Was that successful? He thought not. The company had no powers to construct the line at the Bank, for their powers for acquiring the land had expired. The Committee granted the company Parliamentary powers in 1902, when the company came in defiance of the opinion of the Corporation, who considered that the scheme was bad, their finance bad, and the line altogether undesirable. What prospect was there of getting the fare of 2½d. for 3½ miles, when such companies as the Central London carried passengers 8 miles for 2d., and the Metropolitan 3 and 4 miles for 1d.? The suggestion was ridiculous. The general prospects of the company were *nil*. The company came there with that Bill to pay their debts. They intended to raise £560,000, yet all they required for the construction of the works was £221,000. He contended that the Bill was purely a financial measure.

Mr. Bellernes, replying on behalf of the company, contended that a charge of 2d. was not a high fare.

The Committee deliberated in private, and found the preamble of the Bill proved.

Radio-Telegraphic Convention Committee.

A sitting of this Committee was held on Tuesday, April 16th, Sir John Dickson-Poynder presiding.

Mr. H. Cuthbert Hall, managing director of the Marconi Co., gave evidence. He said the company was formed in May, 1897, and it had an authorised capital of £500,000, of which some £300,000

or £400,000 was issued. The range of their wireless telegraphy service covered the whole of the civilised Empire, with the exception of Italy. The early policy of the company was to develop inventions and endeavour to secure a monopoly. The result of experimenting had been that they had increased the range of transmission from two to three miles in 1896, to 250 and 300 miles at the present moment. They had had an expression of approval of their service from the Board of Trade and Trinity House. The War Office had tried their apparatus, but without success. They had, however, entered into a contract with the Admiralty. The Marconi Co. had also control of the Marconi Marine International Co., which was formed in 1900 to establish communication between ships and shore stations. The company had a capital of £350,000, of which £240,000 had been issued. On the board of that company were many influential men, through whom the company hoped to get the companies in which they were interested to take up the Marconi system. There were also four or five directors of the Marconi Co. on the board. The Marine Co. approached various governments and several shipping companies, and tried to sell them the wireless telegraphy apparatus. The North-German Lloyd Shipping Co. purchased an apparatus, and the Marconi Co. also installed two stations in Germany. In 1901 the Marine Co. was reorganised, as the results achieved by the International Co. were not a success. The new policy adopted was to carry on a public telegraphic service and to sell the apparatus. It seemed clear that the shipping companies would not buy the apparatus unless an organisation was established. Under the old policy of the company, the purchasing company had to organise its own service. They therefore found it necessary to erect stations of their own, and a number of them were built in England, Ireland, and in the United States. The company had an agreement with Lloyd's for 10 years, whereby they agreed to use exclusively the Marconi system for all messages of a maritime nature. When the agreement was signed, Lloyd's pointed out that it was desirable that they should join hands, and thus strengthen themselves against what they believed was a private arrangement between the Admiralty and the Government, whereby in a certain time the Government would take over the control of wireless telegraphy. In 1901 an arrangement was made between the Admiralty and the Marconi Co., by which the Admiralty adopted the Marconi system. After some dispute as to the price to be paid, it was finally agreed to accept £100 a year for each set used. In 1903 the Admiralty made an offer to pay a royalty of £5,000 a year if they were allowed the use of as many sets of apparatus as they required. That offer was accepted. It had been erroneously stated that the Admiralty paid them £40,000; but that was not so, it was only £5,000. The Canadian Government had also adopted their system, and they had an agreement with the Italian Government for 10 years, by which they agreed to use only the Marconi system on their ships. They also had an arrangement with the Western Union Telegraph Co. relative to the transmission of messages. A certain number of competitors had sprung up, but the only formidable one was the Slaby system. There were other systems, but the company considered that they contained the essential features of their system. In one case they brought an action against a company in the United States for an infringement of their patents, and the case was decided in their favour. With regard to the Slaby system in Germany, if they took an action against that system, should it be decided in their favour, they would have to force the Marconi system on the Government. They had been approached by various companies with a view to amalgamation, but they had all been rejected owing to the inequality of the company's business. The Marconi Co. had 180 stations under their control. Their organisation of the service was so complete that one station could send messages to three liners passing down the Channel at once. There was no other company which gave a public service. They had two stations opened for public service in Holland, 15 in Italy, 24 in British North America, seven in the United States, one in Montenegro, and on several ships passing up and down the Suez Canal. There were 96 vessels equipped with their apparatus, including 39 of English nationality, 14 German, nine Dutch, four American, six Canadian, and six French carrying on public service. He did not know of any Atlantic liners that used any system other than the Marconi. Assuming that the Convention were ratified, ships of other nations would only be able to communicate between ships of their respective nationality. By the Convention, the service of wireless telegraphy would be open for anybody to use, and he considered that such common use would cause chaos and confusion. What they needed was centralised control, and the whole service, if it was to prove beneficial, must be adequately controlled. They would find that under the rules and regulations of the Convention there would be a certain competitive spirit between ships or individuals desiring communication. The operators would vie with each other to obtain first possession of the lines. Their company eliminated that difficulty by means of a bonus system. The bonus, however, was only given on the strict understanding that all the regulations of the company were observed. It was not true that their operators had informal conversations over the lines; all transmissions were *bonâ fide* messages. All their stations were under central control, and no company could possibly work their lines satisfactorily unless they had an adequate control. Every other Government was agreed that, *per se*, the Marconi system was the best owing to the complete organisation of its service. He was of opinion that the Convention would have a retarding effect upon technical and scientific progress in wireless telegraphy. Their company had expended £700,000 on developing the business. The German Government gave their support to any scheme brought up by a German firm, but in England that was not so. It had been said that the success of the Marconi Co. was due to the licences that they obtained from the Post Office in 1904. That could not be, for in 1903, Germany was saying that the Marconi Co. was getting a monopoly, and urging the Government to take up some scheme of wireless telegraphy. At the recent Conference in Berlin, New Zealand was not represented, and Canada had never been consulted on the question of a Convention, and he had reason to believe that several other Colonies would not agree to the Convention. Before the Colonies could express their views on the Convention, they had to accept it. He considered that the wireless telegraph companies concerned should have been allowed to be present at the Conference, and certainly the Marconi Co. should have been allowed representation. Great Britain had not forced intercommunication with ships at sea. In conversation with him, a number of delegates had expressed the view that the Convention was an absurdity. As regarded the voting for the articles of the Convention, he believed that Japan was instructed to follow England, Russia followed Germany, and the Portuguese delegate voted the same as France did.

Questioned by Mr. Sydney Buxton, Witness said that Sir Wilfrid Laurier himself had written to their agent that Canada had not been consulted, and he (the Premier) took the view that it was necessary to have one system in use, and that it must be restricted to the nature of a monopoly. He spoke on the authority of Mr. Henniker Heaton for saying that New Zealand was not represented at the Conference. His company had an agreement with a Dutch shipping company for the exclusive use of their system. He was not aware that his company had an agreement with the Argentine Government to the same effect. Their patents could be obtained by the Government if a special Act was passed to acquire them, but he did not think the terms of the Post Office agreement would have been complied with if such an Act were passed. At the time the agreement was made the Government were considering the question of a monopoly, but on the Saturday previous to the Monday on which the Bill was to be read in Parliament, they had a notification from the Post Office, saying that they would reconsider their decision, and the outcome of it was that the agreement was entered into between the company and the Post Office. Lord Stanley himself said that he would see that the terms of the agreement were carried out. If two ships were endeavouring to communicate with one station at the same time, confusion would arise unless the ships were controlled by one company. He did not think it would be necessary to have more rules and regulations if one authority had control over the service. The percentage of errors in the large number of words his company had to deal with was ·42, thus proving that if one company had control, the service could be properly worked without confusion. He considered that the terms of the Convention were impracticable for other countries. Italy signed the Convention subject to the Marconi Co. agreeing to all the terms; if the company did not, there could be no intercommunication. Previous to the Conference the company offered to release various nations from their contracts, but they refused, considering that the Marconi system was the best for their use. America could not sign the Convention until they legislated, and that could not be done until December. If the Convention did go through, the company could escape through certain articles in the agreement.

Replying to Mr. Lambert, Witness said he thought if the Convention were ratified it would be of a distinct disadvantage to British defence interests. He was not aware that representatives of the War Office and the Admiralty had expressed views in an opposite direction to the Committee, but he thought their evidence was very contradictory. The British delegates obtained the "exempted" stations. Seven Governments reserved their opinion as to signing the agreement if the "exempted" stations were not granted. Intercommunication could be forced between ships, but Great Britain did not intend to do that. If those seven powers had stood out of the Convention it would have become abortive. He thought that the attitude of the Admiralty had utterly changed since the Conference. Before the Conference they were against a monopoly, but now they were in favour of it. In August, 1906, the War Office and the Admiralty were of the opposite opinion.

Replying to Mr. Lee, Mr. Hall said he based his assertions on a conversation he had with delegates to the Conference. To ratify the Convention would be to benefit other countries, and he thought that England should look well into the Convention, as it was on the initiative of foreign countries. He asked the Committee not to ratify the Convention.

The Committee then adjourned.

On Thursday, April 18th, a further sitting of the Committee was held, when Mr. John Gavey, post engineer-in-chief to the Post Office, said that in 1896 it was found that the progress of wireless telegraphy was seriously hampered by the fact that mutual interruptions occurred; over a range of 60 miles, and in the narrow surroundings of England, chaos resulted. It did not make any difference what system was used, and he considered that, with intercommunication, interference was inevitable. It had been found that messages could be interpreted at a distance of over 800 miles. Such interference could be minimised by having strict regulations and rules, and with this object in view, the articles of the Convention had been most carefully drawn up. Based on the experience of the delegates, it was found that a wave-length of 360 metres was suitable for ships communicating with the shore, and of 600 metres from ship to ship; 600 to 800 metres was a sufficient range for Government purposes. Communication could be established between places 80 miles apart without undue interference, if rules and regulations were enforced, and if such control were not exercised, a distance of only 50 miles would be subject to interference. It was certainly a question of regulations, rather than of wave-lengths. Ships were required, under the articles of the Convention, to communicate with the shore station nearest to them. It was also

necessary, under the Convention, to employ skilled operators only; if an unskilled operator were employed, he might throw the whole service into chaos. Great Britain would, of course, have no redress, if she did not sign the Convention, if any interruption occurred, for the other countries would only be carrying out their duties as enforced upon them by the Convention, and she would undoubtedly lose the bulk of her traffic, which was the greater proportion of that done in Europe. In his opinion, the Convention ought to be ratified by England.

Questioned by Mr. GWYN, WITNESS said that the range of the apparatus on ships varied from 60 to 100 miles, according to the climatic conditions, but the average was about 80 miles. He did not think ships could correspond with stations beyond that distance with any certainty, but if England stood out of the Convention, he thought that the ships of other nations would install apparatus of a more powerful character, so as to communicate with places at longer distances. Negotiations were in operation, at the time Signor Marconi sold his patent to a company, for the purchase of them by the Post Office, but owing to Signor Marconi's actions the negotiations were abruptly broken off. The number of stations along the south coast were quite adequate to deal with the traffic. The cost of erecting stations was anything from £500 to £1,000, according to the class of apparatus fitted up.

Answering Mr. WEST, Mr. GAVEY said that one of the benefits of the Convention would be that all ships or shore stations would have to converse in such a way as to avoid as far as possible any interruption.

Replying to Sir CLIFFORD PARKER, WITNESS said that there was a sort of organisation in the United States. The Western Union Telegraph had 42 ships fitted up with wireless apparatus, and he understood that they used intercommunication between the ships and the States. At present no ships fitted with the Marconi system could intercommunicate.

In answer to Mr. ATKINSON, WITNESS said that, assuming England did not sign the Convention, and ships now using the Marconi system continued to use such system, they would, of course, ultimately have to give it up, owing to the fact that they must not intercommunicate. Co-operation he considered better than monopoly. The success of the Convention did not depend upon what system was used, but upon proper organisation and control. The ratification of the Convention would undoubtedly have an effect upon the sales of the Marconi apparatus, as other systems would quickly be brought into use. He had no reason, however, to assume that the companies would reject the Marconi system.

In reply to Mr. LAMBERT, Mr. GAVEY said that the British delegates were fully met by the foreign representatives. He knew of no objection to the Convention other than that of the Marconi Co. He characterised the remark that the Post Office delegates had unduly influenced the Admiralty representatives as childish.

Answering Mr. SYDNEY BUXTON, WITNESS said that there were 63 commercial stations owned by the Marconi Co. and 123 by various other companies. From January to December, 1905, the total number of messages sent to ships from shore stations was 541, and from ships to shore 10,297. For the same period in 1906, the numbers were 1,036 and 13,498 respectively.

Capt. E. F. INGLEFIELD, R.N., and secretary of Lloyd's, also gave evidence, and said that Lloyd's had some 1,300 agents and sub-agents, who, in addition to the important duties which they performed as the representatives of the Corporation, were specially charged to transmit at once all the latest maritime intelligence from their respective districts. The most important stations were those situated round the coasts of the United Kingdom, which was, owing to its geographical situation and the predominant part which it played in the business of the world, the principal focus of ocean commerce. Ever since the inception of wireless telegraphy the Committee of Lloyd's had closely watched the development of the Marconi system, and had conducted experiments with other systems at a cost to themselves, up to September, 1901, of about £4,500. In September, 1901, an agreement was concluded with the Marconi International Marine Communication Co. (an off-shoot of the Marconi Wireless Telegraph Co.); but this agreement was varied in certain respects by the "Terms of Settlement" arrived at between the parties in November, 1905. The following Lloyd's signal stations had been equipped with the Marconi apparatus under that agreement:—

Inishtrahull	Equipped April,	1902.
Malin Head	" "	1902.
Brow Head	" December,	1902.
Fastnet	" February,	1904.
Port Said	" March,	1905.
Port Tewfik	" "	1905.
Butt of Lewis...	" April,	1907.
Flannan Islands	" "	1907.
Tory Island	About to be equipped.	
Dunnet Head...	"	

The Brow Head station was equipped by the Marconi Co. for their own purposes. Unfortunately, within two years of the conclusion of the agreement, differences arose between Lloyd's and the Marconi Companies. Litigation took place as to certain matters, and some of these were still *sub judice*. As matters then stood in reference to wireless telegraphy, it appeared to the Committee of Lloyd's desirable, in order to avoid complications, that one system rather than a multiplicity of systems should be used for commercial maritime signalling (in which alone Lloyd's is concerned), and no other system than the Marconi system could be said to be in general use in the United Kingdom. The statements in the preamble appeared to have been made on the assumption that intercommunication might not be possible between various systems of wireless telegraphy, and they were not intended to imply that Lloyd's was then, and would always be, in favour of an absolute Marconi monopoly, and against any proper arrangement for intercommunication. The agreement runs until 1915 (when the Marconi patents would expire), and by Clause 7 Lloyd's undertook not to use, or permit to be used, during that period "any system of wireless telegraphy other than the Marconi system at or in connection with any of Lloyd's signal stations" (except in certain specified countries to which the agreement does not extend, the only important exception being the United States of America). Lloyd's had rigidly adhered to its agreement with the Marconi Co., and would continue to regard itself as debarred from permitting intercommunication at Lloyd's signal stations, unless and until its obligation to the Marconi Co. was over-ridden or a contrary obligation was imposed. It was evident that, if vessels of the mercantile marine were equipped with systems of wireless telegraphy other than the Marconi system, and were debarred from communicating with Marconi-equipped vessels and Marconi-equipped stations, this would be detrimental to the public interest; it was of such great importance that all and any intelligence relating to maritime matters should be received at Lloyd's, that the possibility of intercommunication between vessels and shore stations, irrespective of the system with which they were equipped, could not but be to the advantage of all interested in commerce. As an instance where the general public interests had been endangered and human life jeopardised owing to the refusal of the Marconi Co. to allow intercommunication, he quoted the incident of the United States steamer *Lebanon*, in June, 1906. That vessel was engaged by the United States Government to destroy a derelict said to be endangering all steamers crossing the North Atlantic. While searching for the derelict, the *Lebanon* got into communication by wireless telegraphy with the Marconi-equipped Red Star Line steamer *Vaderland*, in the hope of getting information, and, it was understood, received the following reply:—"We cannot talk with you as we are under the Marconi contract." Thus the Marconi prohibition of intercommunication stood in the way of the performance of valuable services, and might have been attended with serious consequences. The Marconi Co.'s reading of Clause 7 of the Lloyd's Marconi agreement had resulted in the closing of a Lloyd's signal station on Rathlin Island. Abroad, this question of intercommunication had materially affected Lloyd's, because they had recently applied to establish wireless telegraphy stations in various British Colonies, *e.g.*: Jamaica, Ceylon, Barbadoes, St. Helena, Perim, Straits Settlements, Mauritius, and had not been able to obtain the requisite licences from the Colonial Governments, because they made it a condition of the licences that intercommunication should be permitted at the licensed stations. If Great Britain declined to ratify the Convention, it was feared that, by way of retaliation, foreign governments would decline to supply Lloyd's with maritime intelligence from their wireless stations, and possibly might also cancel the privileges granted to Lloyd's at semaphore stations.

Questioned as to whether Lloyd's would again sign a similar agreement with the Marconi Co., WITNESS said he did not think they would. He did know what company they would make arrangements with, it all depended upon the circumstances of the time.

The Committee then adjourned.

A further sitting was held on Tuesday when evidence was given by Sir Oliver Lodge on behalf of the Lodge-Muirhead Wireless Telegraph Syndicate.

North-East London Railway.—The Bill of the North-East London Railway, which seeks to extend the period for construction and to raise the rate of interest paid on capital during construction from 3 to 4 per cent. was before Mr. Emmott's Committee of the House of Commons on Thursday, April 18th. When the Bill was before the Committee some weeks ago considerable discussion ensued on the question of raising the rate of interest, and the Committee on that occasion decided not to grant the increase. Mr. Cameron (Parliamentary agent) represented the promoters. Sir Chandos Leigh (Speaker's counsel) said he believed Sir Douglas Fox was present on behalf of the promoters, and wished to show from figures that when the line was opened it would pay its full percentage. The Chairman said the Committee had settled the question of the rate of interest and could not re-open it. Mr. Cameron produced amending clauses to carry out the decision of the Committee, and the extension of time for construction was granted.

National Physical Laboratory Committee.—According to the *Times*, this Committee has been engaged for some weeks in taking evidence, and will continue to do so. The witnesses examined have been Dr. Glazebrook, director of the laboratory; Dr. Percy Frankland, F.R.S., president of the Institute of Chemistry; Sir William Ramsay, F.R.S., vice-president of the same Institute; and Mr. Bertram Blount, F.I.C.

Oxford and District Tramways Bill.—In the House of Lords on April 17th, this Bill was read a third time and passed.

West Riding Tramways Bill.—This Bill came on Thursday, April 18th, before Mr. Emmott's Committee of the House of Commons on Unopposed Bills. Mr. Frere, for the promoters, explained that the object was to obtain an extension of time for certain tramways authorised in 1904. The company obtained powers for a large system of tramways, and had constructed the greater portion of them, and they now asked for an extension of three years for the construction of the remainder. Replying to Mr. Cauldwell, Mr. Frere stated that there had been no extension of time granted to the company in respect of any tramway. Mr. Andrews, secretary to the company, formally proved the preamble, and the Bill was ordered to be reported for third reading.

London Tramway Bills.—A new committee, consisting of Mr. Lambton (chairman) and Messrs. L. Lever, Ferens and Murphy, has been appointed to consider the London County Council Tramways Bill and the London United Tramways Bill.

Croydon Tramway Accident.—In the Parliamentary Papers for Thursday last week, Mr. Cooper asked the Home Secretary whether the superintendent of the Public Carriage Department inspected the cars of the South Metropolitan Tramways Co., and whether any application had been made to him by the company, for the superintendent to give evidence on their behalf at the inquest on Mrs. Suter held at Croydon.—Mr. Gladstone replied that the Commissioner of Police informed him that the answer to the first question was in the affirmative, and that to the second part in the negative.

LEGAL.

AGINCOURT STEAMSHIP CO., LTD., *v.* EASTERN EXTENSION, &C., TELEGRAPH CO., LTD.

IN the Court of Appeal on Saturday, Sir Gorell Barnes and Lord Justice Kennedy had before them an appeal by the Telegraph Co. from an order of Mr. Justice Bray.

Mr. J. A. HAMILTON, K.C., with whom was Mr. Bailhache, in opening the appeal, said the Great Northern Telegraph Co. was not touched by the decision of the learned Judge. The Eastern Extension Co., however, in this appeal, desired to have that order reviewed. Certain regulations had been framed in accordance with an agreement come to at a convention between shipping companies and telegraph cable companies as to the rights and duties of each in the event of a ship fouling a submarine cable, and the present action, which was brought in the Commercial Court, involved many questions of law of the greatest importance to both ship owners and marine telegraph companies. Some of these points were regarded as preliminary to the hearing of the action, and were ordered to be tried, and it was thought that if decided one way it would be unnecessary to send a commission to Shanghai to take evidence on some complicated questions of fact mentioned in the pleadings. It was against the decision of Mr. Justice Bray on these preliminary facts that the appeal was brought.

Sir GORELL BARNES asked if the appeal was in fact interlocutory.

Mr. HAMILTON replied that it certainly was, because the learned Judge had not given a final judgment in the matter at all.

Sir GORELL BARNES said Lord Justice Kennedy had read the judgment, and considered the issues raised so important that it would be well to adjourn the appeal until it could be heard before a full Court of three Judges.

Mr. ATKIN, K.C., and Mr. W. NORMAN RAEBURN, for the respondents, agreed as to the importance of the appeal, and offered no opposition to its standing over.

Sir GORELL BARNES said they could not then fix a day for hearing the appeal, but the parties would have notice before it was restored to the list.

BOURNEMOUTH CORPORATION *v.* POOLE AND DISTRICT ELECTRIC TRACTION CO., LTD.

ON Friday this case came up for further consideration in the Chancery Division of the High Court, before Mr. Justice Joyce. Previously, His Lordship determined the question arising out of an agreement of March 11th, 1903, between the company and the Corporation for the purchase of the company by the Corporation. There were three items in dispute, parliamentary deposits to the extent of £1,875, sundry debtors £544, and cash in hand £14 10s. The Poole undertaking was to mean the light railways and works of the company, constructed under an order, and all real and personal property belonging to the company for the purpose of the railway works or their management or working. Mr. Justice Joyce came to the conclusion that all these three items belonged to the Poole Traction Co., and, therefore, passed to the Bournemouth Corporation.

The question for further consideration concerned a sum of £7,000, a bank loan, and the point as to whether it was incurred in the ordinary course of business and was outstanding at the appointed day—December 31st, 1903. This had been referred to the Official Referee to ascertain the facts and to go into the accounts. His report was referred to, and after counsel's arguments, Mr. Justice Joyce said he was not clear that the report came to any definite conclusion. The matter was referred back to have in writing from the Official Referee, a clear indication as to what the report decided.

BARLOW *v.* BURY CORPORATION.

AT the Manchester Assizes on the 19th inst., before Mr. Justice A. T. Lawrence and a special jury, plaintiff, a young clerk, sued the Bury Corporation for damages in respect of injury sustained whilst travelling as an outside passenger on a car between Whitefield and Bury, on June 11th, 1906. Negligence was admitted by the defendants, and the jury were asked to assess the amount of compensation.

It was stated in evidence that the trolley-pole of the car by which the plaintiff travelled, by some means unexplained, became entangled with the trolley rope of another car travelling in the opposite direction, and was pulled down. In its descent it struck the plaintiff on the head, and he fell insensible, receiving injury to his back also, it was believed, by falling against the seats. He was confined to bed for two months, and found, when he got upon his feet, that he could not raise himself erect, but walked—as he still did—with his back painfully bent. He had suffered from shock, caused by concussion of the brain, and besides being deformed (it was hoped only temporarily), his eyesight was affected, and he could not read or do any kind of work. The pain he had suffered, he said, was very great.

The jury's finding depended largely on the medical evidence. Some of the most eminent surgeons in Manchester were called, and they were divided in opinion regarding the prospects of the plaintiff's recovery. Two said he was suffering from neurasthenia, and would recover immediately he was relieved of anxiety about this trial; others were of opinion that there had been a strain of the muscles and ligaments in the region of the spine, and he would never recover.—The jury awarded the plaintiff £400.

BUCKLEY *v.* SOUTH SHIELDS CORPORATION.

AT South Shields County Court on 18th inst., before Judge O'Connor, John Buckley and Annie Buckley, his wife, brought an action against the South Shields Corporation, in which they claimed £100 for damages suffered through personal injuries to Mrs. Buckley while a passenger on a tramcar.

Mrs. BUCKLEY said that she was travelling on a car from Stanhope Road to Victoria Road, and, on reaching that place, she prepared to alight. The car was stopped, and witness got hold of a brass handle attached to the body of the car with her right hand, steadying herself by grasping an upright brass pole with her left. Suddenly the lights of the car went out, and, while she was standing on the step of the car, she felt a severe electric shock. She was unable to release her hold for some minutes, and when she did so she fell back on to the road, and became unconscious.

Dr. WHYTE and Dr. EXLEY gave evidence as to the condition of Mrs. Buckley's health after the accident.

JOHN DUNN, electrical engineer to the Law Accident Insurance Co., London, said that, in his opinion, the car must have been defective in its insulation.

Mr. ROACH, for the defendants, submitted that the fact that the lady had had an electric shock was not evidence of negligence, and that there was not a particle of evidence to show that the Corporation could, by any precautions it might have adopted, have prevented what had occurred.

Expert evidence was called on behalf of the Corporation to the effect that the car in question was in accordance with the Board of Trade's most recent regulations.

The jury, after retirement, said that they could not agree, but after a second retirement they found a verdict for the defendants.

ANDERSON AND WIFE *v.* SWORD.

IN the Chancery Division of the High Court on Tuesday, Mr. Justice Parker had before him the case of Wm. Anderson and Wife, against Sword.

Mr. MARK ROMER, K.C., said the action was in respect of a nuisance caused by defendant's electric motor and gas engine which had been placed in his printing works, next door to where plaintiffs lived at 19, Alice Street, South Shields. Originally the action was brought to restrain the defendant from causing a nuisance by vibration, noise and smell. Plaintiffs were owners of the house in which they lived, and Alice Street was a residential quarter. In 1901 the property was conveyed to Wm. Anderson by his father-in-law, and defendant commenced business in Nos. 21 and 23 as a printer. In 1906 he introduced an electric motor, and the noise was increased so much that they shortly afterwards issued the writ. On plaintiffs complaining about the noise and smell, defendant shifted the electric motor, but this did not reduce the noise. Ultimately the works were removed to another part of the town, and in that event, plaintiffs not wishing to press for damages, the case now resolved itself into a question of costs. Plaintiffs described the vibration and noise to those of a ship at sea.

IN the result, it was arranged that defendant should pay to the plaintiffs £110 in settlement, and his Lordship made an order accordingly.

LYNCH *v.* MACARTNEY, MCELROY & CO., LTD.

IN the King's Bench Division, on Tuesday, April 23rd, before Mr. Justice Bigham and a common jury, Mr. John Joseph Lynch, a mechanical and electrical engineer, brought an action for the recovery of damages for an alleged libel, published in the *Malta Daily Chronicle and Garrison Gazette*, against Messrs. Macartney, McElroy & Co., Ltd., electrical engineers. Defendants denied that the words complained of were capable of the construction placed upon them, and pleaded privilege.

Mr. R. A. McCall, K.C., and Mr. Compton appeared for the plaintiff; and Mr. Montagu Lush, K.C., and Mr. Hugh Fraser were for the defendants.

Plaintiff's case, as outlined by Mr. MCCALL, was that in 1903 he entered the employ of the defendants in connection with a tramway which they were laying down in Delagoa Bay, and that in 1905, after that undertaking was completed, he was appointed by defendants as their engineer in charge of tramways which they were constructing in Malta. He was to be senior to everyone con-

nected with the company in Malta, with the exception of Mr. MacIntyre, the acting secretary. There was considerable disorganisation in the defendant's business, and there were also certain irregularities, and the plaintiff applied himself with all his energies to putting the business in good working order. For some time he succeeded, in the defendants' opinion. About January 8th, 1906, the post of general manager in Malta became vacant, and plaintiff applied for the post. Immediately afterwards the defendants issued a notice in the Malta papers calling attention to the fact that they would not be responsible for any orders given or for any debts incurred, unless the orders were given upon an official form and were signed by a director or by the secretary of the company. Shortly afterwards Mr. Macartney, the senior partner, arrived in Malta, and he told the plaintiff that he had some permanent position in view for him; but on March 5th plaintiff was informed that a Mr. Treherne had been appointed as general superintendent. That, of course, was a matter of considerable disappointment to him. On March 12th Mr. Macartney offered him the post of secretary to the company in Malta, but that was not the kind of employment plaintiff considered he ought to be called upon to undertake, and on March 13th he wrote tendering his resignation, as resident engineer, and stating that he would be pleased to know when it would be convenient to defendants to relieve him of his duties. His resignation was accepted the same day, with an expression of regret. The same day, also, defendants wrote requesting plaintiff to return to London and resume his position in the London office. Plaintiff returned to London, and on March 16th the defendants published in the *Malta Daily Chronicle* the following notice:—

"Malta Tramways.

"Messrs. Alexander MacIntyre and J. J. Lynch, occupying the positions of acting secretary and engineer respectively, have been relieved of their duties. The Malta Tramways, Macartney, McElroy & Co., Ltd., are not and will not be responsible for any contracts, orders, debts, &c., unless they are authorised in writing by the company's managing director or general manager.

"Macartney, McElroy & Co., Ltd.
"J. F. Macartney, *Managing Director*."

This notice, plaintiff complained, was calculated to convey the impression to those who read it that he had been dismissed for some misconduct, and that he had been a party to giving irregular orders; and, counsel said, the only course open to him was to bring this action, which he did solely for the purpose of clearing his character of any unjust and injurious imputations which might have been cast upon it. If he received an apology, and defendants indemnified him against the costs of the action, he would gladly accept it.

Mr. Montagu Lush, K.C., said the defendants made no imputation on plaintiff, and never had made it; but it was a different matter when he was asked to submit to a judgment indemnifying plaintiff against the costs, seeing that they did not admit having libelled him at all.

His Lordship said he could not help thinking the advertisement was unfortunately worded, and he did not think defendants could induce the jury to believe that it meant nothing more than that the relations of master and servant had ceased. It was an unfortunate expression, which he dared say was not intended to convey what he thought it did convey. It appeared to him that Mr. McCall was asking for what was not at all unreasonable.

Mr. Lush: I cannot say more than I have.

His Lordship: Then we must go on.

Plaintiff accordingly went into the witness-box, and corroborated his counsel's statement. Cross-examined, he admitted that the post of secretary was offered to him at an increased salary, and that before his letter of resignation reached Mr. Macartney, Mr. Macartney had written the letter asking him to return to London. He was not sure whether he complied with the defendants' request, and called at their office in Malta before his departure, and he was not aware whether Mr. MacIntyre called and was shown and approved a draft of the advertisement of which he complained.

Mr. Lush, K.C., addressing the jury for the defendants, said he could not shut his eyes to the possibility that the advertisement might convey an impression exactly the contrary to what was intended. The defendants were having made upon them claims by local people on alleged verbal contracts with persons connected with the company, and the defendants inserted the advertisement for their own protection. There was no intention to cast any aspersions upon the plaintiff, and the expression "relieved of duties," was an expression which Mr. Lynch himself used in his own letter. It was a common phrase in Malta.

Mr. Macartney, the managing director of the defendant company, said that the plaintiff was very much annoyed because he was not appointed to the position of general manager, and he offered him the position of secretary in Malta, so that he might remain there till the spring. He refused it, and witness wrote him to make arrangements to leave Malta and to report himself at the London offices on arrival home. At the time he wrote that, he had not received plaintiff's letter asking to be relieved of his duties. Plaintiff never called at the office, as requested, before his departure. Witness was fleeced by the traders of Malta, and had summonses on alleged verbal promises which had cost him £10,000. He had paid this, not through the dishonesty of his own men, but through the dishonesty of the Maltese traders, and this was the reason of the advertisement which appeared in the *Malta Daily Chronicle*. He had not the slightest desire to cast any imputation on plaintiff. He liked him.

His Lordship, in summing up, said the jury had to say whether the advertisement, in their opinion, conveyed the impression that the engagement of plaintiff had been determined in circumstances which were not creditable to him. Would any ordinary person think it cast some slur on plaintiff? If so, he was entitled to their verdict.

The jury returned a verdict for the plaintiff, and awarded him £250 damages.

BUSINESS NOTES.

Exhibition.—Exeter's seventh annual trades, electrical, and educational exhibition was opened at the Victoria Hall on Tuesday last week. The exhibition buildings were designed to represent Japan. The Corporation Electricity Department made an exhibit of electric appliances for the first time.

Ferranti (Hamilton) Meter Approved.—In the *London Gazette* for April 19th there appears a note of the Board of Trade's approval of the pattern and construction of the new type continuous-current meter (Hamilton patent) deposited by Messrs. Ferranti, Ltd.

Underfeed Stokers.—We are informed that the Underfeed Stoker Co. have received the following orders for the equipment of water-tube boilers with their stokers:—

Metropolitan Borough of Stepney	8 Babcock boilers (repeat).
Metropolitan Borough of Islington	1 do. do.
Urban District Council of Beckenham	2 do. do.
Woolwich Arsenal (War Office)	4 do. do.
Hereford Corporation Electricity Works	1 Stirling boiler.
Ferndale Collieries Power Station	8 do. do.
Norwich Corporation Electricity Works	2 Babcock boilers.
Devonport Corporation	1 do. do.
For the equipment of internally-fired boilers:—	
City and South London Railway	1 dry-back marine.
Metropolitan Borough of Hampstead	4 Davy Paxman Economics (repeat).
Falkirk Electricity Works	2 Lancashire boilers (repeat).

Italy.—The *Board of Trade Journal* contains a few interesting particulars of subsidies granted and offered for the promotion of national industry in Italy. An example which may be cited is that of the Municipality of Asti, which has granted Messrs. Westerman, of Zurich, 300,000 lire (about £12,000) for the establishment of a hydro-electric generating station in that town.

The Municipality of Cairo Montenotte is contributing half the cost of the purchase of 30,000 square metres of land for the establishment of metallurgical works by Signor Lorenzo Barge. It has also initiated studies for the utilisation of the water power of the Rian di Lerca basin, which is municipal property.

The Municipality of Susa offers the necessary water power for the establishment of a new industry, together with a premium of 50,000 lire (about £2,000), and so on.

Thermit Welding.—Messrs. Thermit, Ltd., are now carrying out some extension work at Bury, and will shortly be commencing work on the track construction at Accrington. Welding is also now in progress at Plymouth and Dundee, and the company have recently received a contract from the Leeds City tramways for the whole of their welding requirements for the present year.

Copper.—It is reported that on 20th inst. the Council of Ministers at St. Petersburg confirmed the conditions for the working in Russia of the English companies known as the Siberian Syndicate, Ltd., and the Mourgout River Copper Co., Ltd.

Book Notices.—*The Technical Index*, April, 1907. M. J. Fitz-Patrick, Brussels. Price 10s. 6d. yearly.—With the first number of the 10th volume Mr. Fitz-Patrick announces that he has assumed control of *La Revue de l'Ingénieur et Index Technique* in English-speaking countries, and the English edition will in future appear under the new title at the head of this paragraph. The excellence of this publication has frequently been pointed out in this column, and we trust that it may have a long and prosperous career.

"Glues & Gelatines." By R. L. Fernbach. London: Archibald Constable & Co. 1907. 10s. 6d. net.

"Fuel, Water and Gas Analysis for Steam Users." By J. B. C. Kershaw. London: Archibald Constable. 1907. 8s. net.

"Locomotives: Simple, Compound and Electric." By H. C. Reagan. New York: John Wiley & Sons. London: Chapman & Hall. 1907. 15s. net.

"Agglutinants of all Kinds and for all Purposes." By H. C. Standage. London: Archibald Constable & Co. 1907. 6s. net.

For Sale.—Messrs. Percy Huddleston & Co. will on May 2nd (Thursday next) offer for sale at Manchester the stock of an electrical fittings manufacturer. Some particulars appear in our advertisement pages to-day.

Messrs. Wheatley Kirk, Price & Co. will at an early date offer for sale by auction the entire contents of the Ferry Electrical Engineering Works, Thames Ditton, Surrey (by order of the receiver of Lionel Robinson & Co., Ltd.) Some further information relating thereto will be found among our advertisements to-day.

Portsmouth Corporation is inviting tenders for the purchase of a lift controller.

Messrs. J. Stone & Co., Ltd., of Deptford, are offering for sale two of 60 and one of 43½ effective h.p. Crossley gas engines; also two General Electric shunt-wound dynamos. Particulars appear among our advertisements to-day.

Catalogues and Lists.—Oldbury Steel Conduits Ltd., Birchfield Lane, Oldbury.—1907 illustrated catalogue and price list relating to their system of electric conduits with fittings and accessories for same. It consists of some 80 pages, an examination of which shows them to contain full particulars of the "Oldbury" patent fittings with roller bearings, the Oldbury patent "grip" fittings, and sockets screwed right and left-hand threads, lamp-brackets, water-tight fittings, wiremen's tools and sundries. The particulars of sizes and prices are carefully set out in well-arranged tabulated form, and are accompanied with boldly-printed cuts.

Messrs. Eckstein, Heap & Co, 5, Chapel Walks, Cross Street, Manchester.—Copies of two advance catalogues have been received from this firm. No. 1, in some 52 pages, deals with and fully illustrates various electric lighting, bell and general accessories, including wires and cables, batteries, bells, contacts, indicators, pulls and pushes, and many sundries. List No. 2 (16 pages) relates to ironclad main switches, enclosed and open-type fuses, and house service fuse-boxes, distribution boards, Waverley quick-break knife switches, and water-tight mill and other fittings. Both publications contain price particulars.

Messrs. Thomas Noakes & Sons, Ltd., 4 and 5, Osborn Place, Brick Lane, E.—Finely illustrated and well arranged catalogue (120 odd pages), containing descriptions of the great variety of their steam engine and boiler fittings. There are five sections—(1) dealing with cocks; (2) with valves; (3) with whistles and lubricators; (4) with cylinder and gauge cocks, water and steam gauges; and (5) describing injectors, feeders, steam traps, fusible plugs, pumps, &c. This last-mentioned section also contains particulars of patent improved electric connectors for electric conductors, Hewar's patent section insulator, with double clamps and feeder terminals for flexible suspension, and Clough's patent any-hand frog.

Diesel Engine Co., Ltd., 179, Queen Victoria Street, E.C.—Excellently got-up brochure (28 pp.) containing full description of the construction of the Diesel engine, and some particulars of results of tests of same. Some fine half-tone views of stations equipped with their engines—among them being the Yorkshire and West Riding Tramway station with its two 300-B.H.P. sets, the Yardley (Birmingham) tramway generating station, where four of 160 B.H.P. each are in service, the Burton and Ashby light railway station, where there are two of 240 B.H.P. each, and so on. A goodly list of users at home and abroad is given at the end.

Messrs. J. M. Henderson & Co., King Street Engineering Works, Aberdeen.—Illustrated card showing their electric Scotch derrick cranes, as used on an Indian railway, their three-ton improved loco. steam crane, and their cable-ways.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—Lists showing, briefly describing and pricing their type 37 maximum circuit-breakers (single-pole) for C.C. circuits up to 600 volts, and showing diagramatically the dimensions of same.

Messrs. Crompton & Co, Ltd., Salisbury House, London Wall, E.C.—Another of their standard-sized lists (U 12), describing and illustrating their direct-reading electrical pyrometer for annealing and case-hardening ovens, gas and steam plants and furnace and flue gases; also a small price-card of ¼ to 1 B.H.P. continuous-current motors.

Birmingham Electrical Fittings Co., Ltd., Broad Street, Birmingham.—Loose price lists of their supply companies' fuse, ironclad switches, and their patent interlocked switchgear.

The General Electric Co., Ltd., London, E.C.—Leaflet (F 1,169) just issued showing a number of new, and generally pleasing, designs of a cheap line in French bracket fittings—Louis XV and XVI styles.

The Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—We have been favoured by this company with a copper pen and ash tray which, while rendering very useful service on our desk, will also keep us from forgetting "P.D.M." manufactures for a long time to come. The firm will be pleased to receive applications from their customers and friends for similar trays.

Messrs. Alfred Herbert, Ltd., Coventry.—New 82-page publication in their standard style and form, being Section E, 1907, first edition of their catalogue. It illustrates in their usual admirable manner a number of the firm's modern capstan lathes and parts thereof, and gives full general and dimensional particulars of same, with illustrations of samples of work done, a table of cutting speeds, &c.

Messrs. Kolben & Co., Ltd., 20, Budge Row, Cannon Street, E.C.—A number of their latest price lists in the now-becoming-usual expansible binder. One contains some extracts from a reprint of the description of the Prague works of the Kolben Co., which appeared in the Electrical Review in 1899. Others give prices and illustrations of standard polyphase motors and generators, turbo-generators, rotary converters, three-phase transformers (air-cooled), direct-current dynamos and motors, also electro-hydraulic power installations (2,000 H.P. compound Francis turbine).

Messrs. Bruce Peebles & Co., Ltd., 1, London Wall Buildings, London, E.C.—Booklet No. 701 just issued is a very finely prepared reprint, on excellent art paper, of the description of the Snowdon hydro-electric installation of the North Wales Power and Traction Co., Ltd., which appeared in our pages in December last. The get-up of the production (30 pages) is well executed, and the firm is to be congratulated upon its appearance. The outstanding features of the undertaking, it will be remembered, are its hydro-electric character, and the high-tension overhead transmission.

Messrs. Sanders, Rehders & Co., Ltd., 108, Fenchurch Street, E.C.—Leaflets describing the "Sarco" automatic CO_2 recorder, with examples of its application.

Messrs. Conduits & Fittings, Ltd, Salusbury Road, Kilburn, N.W.—New catalogue (48 pages), in which are given particulars of the "Conrex" system of conduit wiring. Tabulated figures are given of the number of conductors for stated sizes of conduits, diameters, thicknesses and weights of different heavy gauge screwed conduits, and there are good illustrations, together with tables of prices, &c., of patent malleable iron inspection fittings, split inspection sleeves, enamelled tee-boxes, junction and inspection boxes, reducers and tube ends, multiple switch-boxes, reducing nipples, brackets and pendants, clincher plugs, also tools and accessories for the "Conrex" system. The company makes a feature of a complete system of round junction-boxes, which are described in the catalogue, and it supplies a number of different kinds of benders for use with conduits and other pipe-work; one of the types shown in the list is the popular size for gas size conduit, and another is for use with standard conduit tubing.

Messrs. Applebys, Ltd., 56, Victoria Street, S.W.—Illustrated catalogue (86 pages), containing general information relating to overhead travelling cranes and a special telegraphic code, followed by a general specification of their three-motor electric overhead travelling cranes, with tables of speeds, dimensions of same, &c. Other types and various sizes of overhead electric travellers are dealt with in a similar way, as are also cantilever cranes and Goliaths, and contains a large number of the firm's up-to-date examples of electrical cranes. The book is very fully illustrated.

Messrs. Dick, Kerr & Co., Ltd., Abchurch Yard, London, E.C.—Revised edition of their brochure relating to direct-current stationary motors. Some fine examples of half-tone illustration printing are shown, representing open, protected, totally enclosed, and ventilated and enclosed motors. A table is given of horse-power, speed and efficiency at 220 and 440 volts, also tabulated dimensions. A brief description of the design and construction of the motors is included.

Trade Announcements.—Messrs. Turners and Manville, Ltd., of 81, Fenchurch Street, E.C., have taken larger and more commodious premises at Hopetoun House, 5, Lloyd's Avenue, E.C., and that will be their address for the future.

Mr. Chas. Pullan, of Bradford, has opened a branch office at 19, Duke Street, Cardiff, to deal with the South Wales business, Mr. Brinley Rees being his representative in that district. Manufacturers are invited to send catalogues and discounts.

The Adams Manufacturing Co., Ltd., notifies that its London office and showrooms are now at 106, New Bond Street, W.

Messrs. A. Brown & Co., electrical engineers, have opened business premises at 743, High Road, Leytonstone.

Mr. E. Dewhurst, electrical engineer, of Preston, has removed his business from 89, Fishergate to Mount Street.

Messrs. Mountain & Gibson, Ltd., electrical tramway and railway engineers, of Elton Fold Works, Bury, Lancashire, have removed their London offices to more commodious premises in Albert Buildings, 49, Queen Victoria Street, London, E.C. The care of the London Sales Department will be in the hands of Mr. F. W. Newman, director, as heretofore, but owing to the increased volume of business, he will be joined by Mr. H. McLawrance, director (from the works), who will attend more particularly to the engineering and technical work. We understand that the business of the firm has very largely developed recently, and some extensive additions have been made to the works at Bury. The plant has been re-organised and added to, and at the present time the works are very fully employed. The orders which are in hand include complete tramcars (including the trucks) for Llandudno, Delhi, Coventry, Portsdown and Horndean; and trucks for Nottingham, Leyton, West Ham, Wemyss, Pontypridd, Birkenhead, Stalybridge, Dublin, Bury, Derby, &c., also for Calcutta and Montreal. In addition, the firm have recently secured the contract from the London County Council for the supply of 300 pairs of maximum traction trucks, which are similar to 350 pairs previously supplied. This recent order constitutes the fifth consecutive order which the L.C.C. has placed for Mountain & Gibson's improved type of centre-bearing swing-bolster maximum traction trucks, making a total of 650 cars which will be mounted upon this special design. The other orders referred to include a large number of the firm's patent radial trucks. We learn that the firm have added many important improvements, and modified the designs of their various classes of trucks, to meet the requirements of up-to-date tramway practice.

Mr. Walter R. Rothenberg, late of the firm of the Electromotor & Dynamo Co., has joined Messrs. E. P. Allam & Co., 11, Red Lion Street, Clerkenwell Road. Messrs. E. P. Allam & Co. have also appointed Mr. C. B. Converse to represent them in the London district for the sale of their Premier motor-starters and automatic rheostats, vice Mr. Walter Baker, who has resigned his position with the firm.

Durham.—According to the *Iron and Coal Trades Review*, one of the effects of the installation of Otto-Hilgenstock coke-ovens at Messrs. Priestman's Axwell Park Colliery has been that the County of Durham Electrical Power Distribution Co., Ltd., has formed a subsidiary company—"The Waste Heat Company"—to erect other sub-stations, the power company taking the entire waste heat from the colliery-coking plant, and supplying the proprietors at a fixed charge per unit with all the power required for working their machinery above and below ground.

Bankruptcy Proceedings.—A supplemental dividend of 10¾d. in the £ is payable from April 26th in *re* Walter Morton and W. T. Sampson (Morton & Sampson, electrical and mechanical engineers, Warrington). Official Receiver's office, Byrom Street Manchester.

T. E. R. Phillips.—At Liverpool Bankruptcy Court on Friday, Judge Shand approved of a composition of 7s. 6d. in the £ under this failure.

Transformer Oil.—The contract for the supply of transformer oil required by the Newcastle-upon-Tyne Electric Supply Co., Ltd., for their numerous new stations has been secured by Messrs. R. Henzell & Co., Northern Oil Works, Newcastle-on-Tyne.

Dissolutions and Liquidations.—British Uralite Co., Ltd.—Creditors are to send particulars of their debts, &c., to the liquidator, Mr. R. L. McLaren, 16, St. Helens Place, E.C., by May 31st.

Northern Engineering Co., Ltd.—A meeting of this company is to be held at Somerset House, Halifax, on May 27th, to hear an account of the winding up from the liquidator, Mr. E. Fleming.

C. J. Utley & Co., electrical and general engineers, Overton Road, Leicester.—Messrs. C. J. Utley and T. Standley have dissolved partnership. Mr. Standley attends to debts, &c.

British Pioneer Electric Light and Power Co. of India, Ltd.—A meeting is to be held on May 22nd at 35, New Broad Street, to hear an account of the winding up from the liquidator (Mr. R. Walt Blackburn).

East African Rubber Exploration Syndicate, Ltd.—A meeting is to be held on May 21st at 34 and 36, Gresham Street, E.C., to hear an account of the winding up from the liquidators (Messrs. A. Clarke Vincent and E. Woodrooffe).

LIGHTING and POWER NOTES.

Barnes.—The Council is repaying from electricity revenue, £919 taken from the rates in 1903 and 1904; it is also allocating £750 in relief of rates from the same source.

Bury (Lancs.).—The Electricity Committee anticipates a net profit on the year's working of £3,000. How this shall be allocated has not yet been decided.

Cardiff.—A long discussion took place last week as to the progress of the electrical contract at the new city hospital at Whitchurch. The total cost of the electric lighting is estimated at £14,013, a figure which has been adversely criticised locally. Mr. Arthur Ellis, who has had the work in hand, showed that the cost per point, including fittings, wiring, &c., and feeder cables was £2 7s., as against £4 12s. at the new Cardiff City Hall and Law Courts, exclusive of fittings. The buildings are to accommodate some 700 patients and 100 attendants.

It was reported that Messrs. Firth & Sons, the contractors for the wiring at the hospital (whose contract was determined about a year ago, after which they went to arbitration and were awarded £1,422), had now made a further claim against the Corporation, and had issued a writ for damages.

Chichester.—The E.L. Co. has informed the T.C. that it is now prepared to satisfy the B. of T. as to its ability to carry out the works under the E.L. order.

Clydebank.—A feature of the new Rothesay Dock at Clydebank, near Glasgow, is the use of electrical plant to the exclusion of hydraulic and steam machinery. This is understood to be, at the present time, the only dock in the country so completely equipped. There are four coal hoists and 30 cranes, besides capstans, transporters, turntables and other auxiliary machinery. The power station occupies a central site, and consists of engine house, condensing and boiler houses. The coal hoists are of German design constructed by Sir Wm. Arrol & Co., Ltd., and one of them, which has a lift of 60 ft., can handle a gross load of 32 tons, and is stated to be capable of loading ships at the rate of 800 tons per hour, while the other hoists are somewhat less in height but equal in capacity. The quay capstans are each capable of hauling a load of over 200 tons on the level.

Continental Notes.—Italy.—The Societa Generale Elettrica del Adamello has been formed at Milan with a capital of 10,000,000 lire, which may be raised to 20,000,000 lire. The company proposes to establish hydro-electric works in the Camonica Valley, Province of Brescia, to produce 30,000 h.p. at first, and 100,000 h.p. later. The energy produced will be utilised to a great extent by the two large Milan electrical firms, Edison and E. Contie & Cie. The Meridional Railway Co. is also interested in the new company, and will probably introduce projects for the electrification of its lines. Signor Comm. Mangili, of the Meridional Railway, is to be president of the new company, and several well-known financial firms are taking part in its formation.

Spain.—A company has lately been formed in Madrid with a capital of £176,000, and the title La Sociedad Dinamica Espanola, to put down a plant to utilise the water power of the River Tajo in the generation of electrical energy, and to transmit the same a distance of 60 kilometres, to Madrid, for lighting and power purposes.

Cotton Mill Driving.—A writer in the *Manchester Guardian* discussing the advantages of electric driving, as compared with steam, in cotton spinning mills, says: "The electric driving gives a steadier run to the machinery, which, in a modern cotton mill, means better work, fewer stoppages, and increased production. This increased production has been variously calculated, and no doubt it depends much on circumstances and management. At a mill where one of the latest tests was made, the production went up between 4 and 6 per cent. Other trials have shown increases of from 7 to 12 per cent. A gain of 7½ per cent. is equal to the production of an additional 6,000 spindles in a mill of 80,000 spindles, and the importance of such an increase may be seen when it is stated that an increased production of only 2 per cent. would be sufficient to cover the cost of the coal bill. If, as some authorities have stated, production can be increased to the extent of 10 or 12 per cent., the added value is much greater than the extra cost."

Dublin.—An interesting power and lighting plant is being installed at the Irish International Exhibition, to be opened shortly. Both gas and electricity are to be used for lighting purposes; Messrs. W. Coates & Son, Ltd., of Belfast and Dublin, are responsible for the electrical work. The generating plant includes three Babcock & Wilcox boilers, with a capacity of 30,000 lb. steam per hour. The boilers are equipped with chain-grate stokers, superheaters and induced draught plant; the boiler feed plant includes pumps and feed-water heaters. The electrical generating plant includes a 630-I.H.P. vertical triple-expansion Coombe Barbour engine coupled to a Westinghouse generator of 400 KW. capacity; a 450-I.H.P. vertical cross-compound Corliss engine by the same firm, driving a similar generator; two 120-H.P. high-speed sets, the engines by Workman Yeames & Co., and the dynamos by the G.E. Co.; also to take the day load, 525 H.P. of gas-driven generating plant. The latter includes a 350-B.H.P. National-Siemens set and a 175-B.H.P. Crossley-G.E.C. set. The main switchboard was supplied by the G.E. Co. and the distribution cables (underground) by Messrs. Henley. The lighting, by means of arc and incandescent lamps, is on a very extensive scale, and some 50 electric motors will be employed in driving machinery.

Ealing.—The T.C. has rejected an amended offer received from the Metropolitan Electric Supply Co. for the supply of energy in bulk. The electrical engineer reported that the offer was not sufficiently advantageous to justify the abandonment by the Council of its own generating plant. In reply to a question, Alderman Peal said it was not practicable to adopt a supplementary supply, and it would be most unsatisfactory to have two different systems.

Hipperholme.—The U.D.C. has sealed an agreement with the Electrical Distribution of Yorkshire, Ltd., for transferring to the latter the Council's prov. order.

Limerick.—The L.G.B. has sanctioned a loan of £5,500 for the extension of the Electric Lighting station. The addition to the plant will include one 250-H.P. multi-cylinder gas engine and dynamo, a pressure gas producer and other accessories.

London.—Poplar.—At the meeting of the B.C. on Thursday of last week, the Electricity Committee submitted a report with reference to the necessity for extending the boiler and converting plant, the chief recommendations of which appeared last week. The estimated capital outlay necessary for the extensions was £9,000, made up as follows:—One boiler £2,800, one economiser £1,000, one chimney £800, one converter £1,550, one E.H.T. feeder £1,880, one L.T. feeder £1,000, contingencies £50. The Committee have considered the possibility of meeting the difficulty either by (1) accumulators; (2) bulk supply from another undertaking; (3) discontinuing the public lighting by electricity, wholly or partially; (4) arranging with consumers not to take current on the peak of the load. With regard to these alternative suggestions, the engineer reported that the estimated cost of the necessary battery of accumulators was £6,750, in addition to the cost of an extension of buildings requisite to accommodate the plant. There was no probability of obtaining a bulk supply for a peak load only, and the best terms yet suggested for a bulk supply, viz., in the L.C.C. Electric Supply Bill, which is not available, would involve a rental of £3 15s. per KW. for a supply of 500 KW., equal to £1,875 per annum, and a further charge of ·22d. per unit for current supplied, in addition to which an expenditure of £2,500 would be necessary for transformers and mains; assuming a peak load could be obtained on these terms of 500 KW.-hours per day for 30 days in the year, the cost per unit would amount to 33·15d. The only present available bulk supply was that of the Charing Cross Co., who quoted £4 per annum for each KW. of maximum demand, and ·5d. per unit for all energy delivered untransformed, which is the price the Council gives to its own customers for transformed energy. The capacity of the public lamp connections is 205 KW., and the discontinuance of such lighting would not materially influence the present capital requirements. With regard to arranging with consumers not to take current on the peak of the load, the engineer advised that it was most undesirable. In view of these representations it appeared to the committee that the suggested extensions were necessary and inevitable. The revised figures, based upon the quotations above referred to, amounted to £5,900, and the electrical engineer would carry out the work of laying E.H.T. cables and boiler foundations at an estimated cost of £950. In conclusion, the Committee recommended the acceptance of the following tenders:—Clark, Chapman and Co., boiler plant £2,100; Western Electric Co., cable £1,300; and Bruce Peebles & Co., 500-KW. motor-converter £1,550. The Council adjourned the consideration of the report.

Fulham.—The Committee has instructed the engineer to make the necessary experiments to test the value of the destructor for steam-raising purposes at the earliest possible date, and report the result.

Battersea.—The work of lighting by electricity the Nine Elms district has been completed in accordance with the scheme approved by the Council in July, 1905.

Wandsworth.—The L.C.C. has written to the B.C., stating that the Electric Supply Company has offered, without prejudice to any appeal to the arbitration of the B. of T. which it may decide to make at any future time, to establish as a beginning seven testing stations at or near positions indicated by the County Council. The Highways Committee of the L.C.C. is of opinion that a further number of testing stations should eventually be provided, but it considers that the provision of seven stations may be accepted as a commencement.

St. Pancras.—At the last meeting of the B.C. a report was read to the effect that there had been a breakdown of the electrical plant, and that the contractors, Messrs. Parsons, had offered to put in a new armature at the King's Road station for £500, and to repair the present armatures free and make them run satisfactorily. After considerable discussion, it was decided to accept Messrs. Parsons' offer.

Stepney.—At the meeting of the B.C. on the 17th inst., the proposal of the L.C.C. to vary the maximum period which will in future be sanctioned by the L.C.C. for repayment of loans for electricity purposes was considered. The existing periods (those in parentheses) and the proposed new conditions are as follows:—Freehold land (60 years) 60; buildings (42) 50; mains (42), 30; plant (42), 20; house services (42), 12; meters (10), 10. It was decided to call the attention of the L.C.C. to the prejudicial effect of these alterations, and to communicate with other Councils who may be similarly affected by the alterations.

L.C.C.—The Finance Committee, in a report presented at Tuesday's meeting, stated that the Marylebone B.C. had now supplied further information in regard to the sum of £56,178, which was part of a loan of £136,162 for which sanction to borrow was applied for in respect of the cost of additional generating plant, mains, meters, house services, &c. After due consideration the Committee was of opinion that the Council should sanction the sum of £49,136, but the Committee was unable to deal at present with the balance, which included £5,767 for engineer's commission. Having regard to the large expenditure by the Borough Council, the Committee had informed it that it would feel great difficulty in recommending the Council to approve any further loan, and that only loans for such additional expenditure as was absolute necessary would be considered. It was resolved to sanction the loan of £49,136 as suggested by the Committee.

Southwark.—The E.L. Committee has considered a report from Messrs. Price, Waterhouse & Co., chartered accountants, dealing with the question of provision for renewals, &c. Taking the L.C.C. standard for repayment of loans, the Southwark authority should have set aside some £4,000 in 1905-6, or 4½-5 per cent. on the total capital expenditure. If this provision had been made, in addition to other necessary charges, a deficiency for the year of £3,505 would have resulted. Reckoned on this basis, the depreciation to date would amount to £18,071, whereas loan repayments to date only amount to £8,190, or, including the reserve balance, £8,963. The Committee decided that, in future, the renewals reserve should not be available for ordinary repairs, and that the amount placed to the fund shall be decided independently of the profits, and shall in no case be less than the actual profits earned until the reserve fund is adequate for its purpose.

Manchester.—During the week the Electricity Committee of the City Council met to frame its estimate of receipts and expenditure for the current year. The accounts for 1906-7 were found to be highly satisfactory, for the profits admit of a contribution of £10,000 by the department in relief of the city rates. During the past six or seven years the department has done little more than pay its way, but, thanks to the improved load-factor and careful management, its position is now fairly strong. It was in 1900 that the Committee last made a contribution of £10,00 in aid of the rates. In 1901 it gave £3,500, and in subsequent years nothing at all. The provision of £10,000 is, therefore, a welcome surprise to the ratepayers. Moreover, the charges for energy have been reduced, and the Committee intends to lower its charge to the tramway department for energy supplied for running the cars, during the year just ended. Last year's estimated expenditure was £341,300, but the amount actually spent was £347,047. The latter amount includes £40,000, transferred to renewals suspense account, against the £30,000 that had been estimated. A sum of £25,724 goes to the reserve fund. The coal bill last year amounted to £42,533—a sum lower by £3,200 than had been estimated. In the present year, it is feared, the Committee will be less fortunate. It will have to pay some thousands of pounds more for coal supply. The sum it has put down in the estimate is £55,000. In liquidation of debt, during the present year, the Committee hopes to pay £71,000, against £64,045 in the year just ended. The amount received last year for supply, and in meter and motor rentals was £345,819, which is nearly £7,000 above the estimated sum. During the present year it estimates £350,000. On capital account the Committee purposes spending, in the course of the ensuing 12 months, £111,500, of which £46,000 is for generating stations, buildings, machinery, &c., and £30,000 is for buildings and transformers at distributing stations. Street lighting is, as yet, but a small item in the Committee's expenditure account, being only £600 last year, and £500 this year.

Newcastle West.—Mr. W. Phelan has a scheme in hand for the electric lighting of this town, and has approached the County Council for liberty to lay a main through the streets.

New Zealand.—Auckland.—The City Council has accepted the tender of Messrs. Turnbull & Jones, Ltd., at £11,808 for electric lighting plant. The work is to be completed by August 23rd next, under a penalty of £100 per week. A tender of the Australian General Electric Co. was some £1,000 lower, but that company declined to accept the penalty clause, which, it may be mentioned, was added after the tenders had been received.

Preston.—The T.C. has been recommended to have the central area of the town lit by 64 6-ampere lamps, to be supplied with electricity by the National Electric Supply Co.

Rochdale.—The net profit on the electricity undertaking for the past year is £4,135, or £441 more than in the previous year. The receipts amounted to £17,286, against £14,417—an increase of £2,869. Of this, about £2,000 is for energy sold for tramway purposes, and there is an advance of over £800 on sales to private consumers. The Electricity Committee recommends that £2,000 of the present profit shall be devoted to relief of rates, and the balance of £2,135 placed to reserve, which now stands at £2,163. A year ago the Council took £2,350 of the £3,694 profit in aid of the rates, and placed £1,344 to reserve. The contribution to the rates in 1905 was £1,000.

Southend-on-Sea.—The T.C. has reduced the price of electricity to prepayment users from 6d. per unit to 5d., including meter rent, and has decided to charge £13 14s. per arc lamp per annum for public lighting.

Smethwick.—A protest has been forwarded to the B. of T. on behalf of a number of burgesses of Smethwick, urging the department not to ratify the agreement recently entered into between the Corporation and the tramway company, with reference to the transfer of the E.L. order of 1898 to the latter.

South Africa.—Port Elizabeth.—In reference to our note of last week regarding the granting of an additional loan of £25,000 for the completion of the Port Elizabeth electric lighting scheme, it will be of interest to refer in detail to the estimated and expended amounts, which were made public. It will be remembered that the original loan was £100,000, and out of the £25,000 now required, £11,000 has already been spent. The following table shows the estimates and expenditure under various headings:—

	Estimated.	Overspent.	Underspent.
Buildings	£12,000	—	£462 14 4
Boiler house	4,560	£4,713 9 3	—
Battery and booster	2,921	—	202 6 3
Engine room	12,010	837 14 11	—
Mains	26,500	9,071 2 5	—
Workshop	450	132 6 1	—
Meters and services	750	4,275 14 0	—
Office furniture	250	—	73 17 9
Preliminary expenses	3,500	75 6 11	—
Cost of site	3,330	—	—
Flotation expenses	5,087	11 8	—
Contingencies	1,000	—	1,000 0 0
Street lighting	11,000	1,504 2 7	—
Totals	£83,358	£20,610 7 10	£1,738 18 4

The following unestimated items, including £4,000 in extras, were also overspent, £8,238 7s., leaving a balance overspent of £27,109 17s. The principal cause of the estimates being exceeded is, in the case of the engine and boiler house, due to the contractor's failure to complete same, and certain alterations that were necessary in consequence, to the foundations for the plant; in the case of meters and services, due to having to compete with a powerful monopoly, the South African Lighting Association; and in the case of mains and street lighting, to under-estimating.

Mr. J. C. Kemsley, Deputy-Mayor, in the course of some remarks, recently, gave some interesting returns, which would warrant the extra loan being granted, and mentioned that they had at present 215 light consumers and 160 H.P. in motors, the average number of connections per month being 21, though such can hardly be continued for long, and the average revenue per month per consumer was £1.

Walthamstow.—The financial statement made at the last meeting of the U.D.C. mentioned that a loss of £1,487 was estimated on the electric light undertaking for the next half year. There had been a loss on the tramways during the year of £2,900.

Watford.—The L.G.B. inquiry into the application of the U.D.C. for a loan for E.L. purposes was resumed on April 17th, when the clerk stated that the amount applied for had been reduced from £13,500 to just under £9,000, the coal conveyor plant and other items having been abandoned. The Inspector again adjourned the inquiry.

West Ham.—The Electricity and Tramways Committee of the Corporation recently reported that it had had under consideration a letter from the L.G.B., with regard to the Council's application for sanction to borrow £4,308 and £13,326 to defray excess expenditure incurred in respect of the Abbey Mills and Canning Town electricity stations respectively, £17,505 for additional plant, £17,212 for the extension of the supply of electricity to the Silvertown district, and £23,300 to meet prospective expenditure on cables, meters and transformers. The letter stated that, as regarded the first two items, the Board found that the excess expenditure arose, almost entirely, not from the insufficiency of the original estimate, but from the failure of the T.C. to provide

out of revenue the sum of £18,229, which, when sanctioning the loans amounting to £218,460 in 1903, the Board deducted as representing the debt outstanding on the Abbey Mills station. It appeared that an additional amount should be found by the T.C., making the total £25,202. The Board thought that, in view of the continued use of the Abbey Mills buildings, they need not be regarded as superseded. A sum of £17,983 could, therefore, be reduced by £11,241, which would leave £10,646 to be found on this account. The Board would be prepared to sanction a loan for £2,680, the difference between this sum and the amount required to close the Canning Town account. In conclusion, the letter stated that on receipt of information showing how the Council proposed to find the sum of £14,161, the amount for which the Board was not prepared to sanction loans, it would give its sanction to the borrowing of £992, £2,680, £17,076 and £23,300. The borough treasurer submitted a report to the Committee on this letter, and it was decided to ask the Board further to consider the matter. The Committee has authorised the electrical engineer to undertake small motor wiring orders for execution by the men fixing the motors, where the estimated cost of such works does not exceed £5.

West Ham.—A letter was received by the Corporation from the Barking U.D.C. suggesting the formation of a joint Board or Committee for the purpose of arranging a system of inter-running on the tramway system of the whole of the East End of London. It was suggested that the board should consist of three members from each authority. The tramways manager (Mr. Blain) did not consider the proposal appropriate at the present time, and the Council decided to take no action in the matter at present. The L.C.C. has rejected the terms offered by the West Ham Council for the working of the tramways in Bow Road when reconstructed. The West Ham tramway manager has the matter under consideration, with a view to offering other terms.

Yardley.—The offers of the Birmingham Corporation, and also of the Staffordshire and Shropshire Electric Power Co., of an electric supply in the district were recently considered by the Council, and while a preference was shown for Birmingham, it was stated that the offer of the power company would still be considered. Negotiations are to be resumed with Birmingham, with a view to securing better terms.

TRAMWAY and RAILWAY NOTES.

Aston.—A special meeting of the T.C. held last week authorised the borrowing of £100,000 "for the purpose of adopting and equipping for electrical traction the tramways within the borough belonging to the Corporation and purchased from the Birmingham and Aston Tramways Co., Ltd., and authorised under the Aston Manor Improvement Act, 1903." In the course of the discussion the town clerk said that up to the present time the tramways undertaking had brought about an expenditure of £240,000. Of that amount £40,000 had been raised from the Ecclesiastical Commissioners for the construction of tramways in Victoria Road, and £100,000 from the same source for the purchase and transfer of the undertaking of the old Aston and Birmingham Tramways Co., leaving a balance of £100,000 now to be raised. The annual repayments would amount to £5,177, and extend over a period of 35 years. The Corporation seal was affixed to the mortgage.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee on the 22nd inst., Sir Robert Anderson presiding, the sub-committee appointed to consider the desirability of purchasing the Cave Hill and Whitewell Tramway system—the directors of which, it may be recalled, were recently seeking parliamentary powers to run over the Corporation's lines in the suburbs of Belfast—reported that it recommended the purchase of the system at £60,000. The recommendation was adopted, subject to the confirmation of the Council. The intrinsic value of the system was laid down at £40,000, but the figure now recommended is that offered by the Corporation prior to the company's promoting the original bill some years ago. The announcement has given much satisfaction in Belfast, as it will save the taxpapers the expense of fighting the matter out in Parliament. The company wanted another £10,000, but the sub-committee of the Corporation would not make any advance on the original offer of £60,000.

Birmingham.—At a meeting of the Tramways Committee, on the 17th inst., it was reported that hopeful progress was being made in the negotiations for overcoming the deadlock by which facilities have hitherto been refused for a through working of the Erdington route over the lines passing through Aston Manor, at present leased to the British Electric Traction Co. Suggested terms of settlement have been submitted to all parties concerned. The hoped-for settlement should also enable an arrangement to be made for through working of the Perry Barr route, of which the portion between Perry Barr and Chain Walk, Birchfield Road, belongs to the Handsworth District Council, and has just been reconstructed as an electric tramway.

Bolton.—The Tramway Committee has favourably received a proposal for through running to Bury, made by the latter town. The service is expected to be in operation at Whitsuntide.

Bradford.—A month's trial is to be given to a car fitted with Mr. C. J. Spencer's patent extensible axle; this will run between Bradford and Leeds, where the gauges are 4 ft. and 4 ft. 8½ in. respectively. A preliminary run gave every satisfaction.

Bury (Lancashire). — A report presented to the Tramway Committee this week shows the receipts for the past year, to March 31st, to have been £50,481 12s. 11d., and the net profit, after deduction of all charges and expenses, about £5,000. The Town Council will be recommended to allocate £2,500 to reserve, and to carry a further £2,500 to the borough fund for the relief of the rates.

Continental Notes.—Switzerland.—A Swiss company has been formed to construct a tramway service without rails between Basle and Huningue, a town on the Swiss-German frontier. The motive force will be electricity supplied by aerial wires. The cost of the scheme is stated to be 50 per cent. less than if an ordinary tramway line with rails were constructed.

Austria.—Comprehensive plans are under consideration by the Ministry of Railways for the introduction of electricity on all the State Railways in the western part of Austria, embracing the lines between Vienna and Bregenz, and Salzburg and Trieste. It is proposed to use the water-power in the country through which the roads run, and an engineering commission has been engaged for some months in investigating the amount of power available.—*Pall Mall Gazette.*

Holland.—The Holland American Co. has obtained from Westzaar Municipal authorities the concession for the construction and working of an electric tramway in their district.

Italy.—A company has just been formed in Brussels, with a capital of £100,000, to be known as La Société du Tramway Electrique de Notre Dame de la Garde à Gênes, to construct and work electric tramways at Genoa.

Croydon.—The Tramways Committee recommended the B.C. on Monday to enter into an agreement with the South Metropolitan Electric Tramways and Lighting Co., Ltd., for through cars between West Croydon and the Crystal Palace (high level) and Penge. At present, on the borough boundary, passengers have to change cars, at which there has been much complaining. Under the proposed agreement the Corporation and company would take the entire fares on their own respective systems, and each pay the other 3d. per car-mile run in the outside district. The agreement would be subject to three months' notice. The recommendation was adopted.

An inquest was recently held on Mr. Collins, of Addiscombe, the second passenger to succumb to injuries received in the tramway accident at Carshalton. The jury found that the driver was going at a somewhat excessive rate, considering the curve, whilst the application of the brake by the conductor tended to cause the wheels to skid, and increased the difficulty. The jury added that the brakes and equipment were in efficient condition, and expressed appreciation of the instructions of the general manager.

Ealing.—The B. of T. has replied to the T.C. respecting the complaints as to noise occasioned by the L.U.T. cars. The Board states that the nuisance, of which complaint has been made, does not appear to be a matter over which it has any compulsory powers, and encloses a copy of a letter received from the tramway company stating that there was no justification for the complaint, and that the improvements made to the cars had been entirely successful in removing the noise. The Highways Committee is to consider and report as to whether the Council shall itself take action, and invite the Acton and Hanwell U.D.C.'s to join in the agitation.

Elland.—The National Electric Construction Co. has recently assured the U.D.C. of its intention to carry through a proposed tramway scheme for joining Halifax and Huddersfield *via* Elland.

London.—L.C.C. Tramways.—The adjourned report of the Highways Committee with reference to the proposed construction of a subway station for the tramways near the Strand, beneath Wellington Street, was considered at Tuesday's meeting of the L.C.C. After discussion the Council resolved not to take any further action in the matter, on the grounds that a saving of £20,000 would be effected by omitting the station, that the subway to the Embankment would be completed in half the time without the station, and that the advantages of the station to the public would be of a limited character.

The Highways Committee reported that the total traffic receipts on the tramways for the year from April 1st, 1906, to March 31st, 1907, amounted to £809,570 from the lines worked by electric traction, as compared with £614,297 in the previous year. The receipts from the lines worked by horse traction reached £567,410, as against £723,011 in 1905-6. These figures make a total of £1,376,980 for 1906-7, as compared with £1,342,308 in the preceding year, being an increase of £34,672, while the mileage worked was also greater in the past financial year.

The Council adjourned for a week the consideration of a long report by the Highways Committee with reference to the excess of the actual cost over the estimated cost of the work relating to the removal and alteration of water and gas mains, &c., in connection with the reconstruction of the tramways from High Street, Wandsworth, to Westminster Bridge and St. George's Circus. It appears that the estimate amounted to £33,500, whereas the actual outlay will amount to £86,500, showing an excess of £53,000, which the Council is asked to approve. In the course of the report the Committee stated that difficulties arose largely owing to the proximity of the extensive works of one of the water companies, and

also of the works of the South Metropolitan Gas Company. Although at the time the figure of £33,500 was given as the probable cost of altering the gas and water mains, if the conduit system were adopted, it was understood that the sytem of pipes and mains traversing the route was so exceptional in character as to make it extremely difficult to accurately estimate the cost of this portion of the work. In the circumstances the suggestion was made that, for the portion of the tramways between the points above mentioned, the overhead system of traction should be adopted, and a scheme was accordingly submitted to the various road authorities concerned, namely, the Battersea, Lambeth and Wandsworth B.C.s, providing for the adoption of the conduit system between the London termini of the tramways and the junction of Nine Elms Lane and Wandsworth Road, and of the overhead system from that point *vid* Nine Elms Lane, Battersea Park Road, and York Road to High Street, Wandsworth. This scheme would probably have cost about £112,500 less than the present scheme. The proposal for overhead traction was communicated to the road authorities concerned, namely, the Battersea and Wandsworth B.C.s, but they were not prepared to agree thereto, and it was therefore decided to adopt the conduit system of traction. The total cost of the Westminster-Wandsworth tramways works out at £22,315 per mile of single track, as compared with £19,530 per mile in the case of the first section of the northern tramways.

Manchester.—The Tramways Committee, at a meeting held a few days ago, decided that its contributions out of the profits of the undertaking to the city fund, in relief of the rates, this year, should be as before, £55,000. It was also resolved that a sum of £4,200 should be set aside out of revenue as the Committee's proportion of the cost of the Infirmary site and consequent street widenings, and a further sum of £3,500 for the promotion of the Corporation Tramway Bill. The Committee estimated that £198,616 would be needed for the expenses of the year's working; the actual expenditure was £196,845. For the coming year the estimate amounts to £203,464. For the year ending March 31st, 1908, it is estimated that there will be an income of £745,024, as compared with £719,634, the approximate income for 1906-7, which was £17,506 in excess of the estimate at the beginning of the financial year. A surplus of £59,000 is anticipated for the coming year, after all deductions have been made. The question of halfpenny fares, for the convenience especially of working people, has been considered by the Committee, but no decision has yet been arrived at. A sub-committee will inquire into the subject.

Newcastle-on-Tyne.—The T.C. recently increased the estimates for the rates, which latter show an increase over the preceding year of 4d. in the £. To prevent a still further advance it was agreed to appropriate £12,000 from the Corporation Tramway's profit, being the equivalent of 2d. in the £. In the course of the discussion the tramways undertaking was blamed for having largely contributed to the Corporation's capital debt; also with incurring expense in street widenings, &c., but the Chairman of the Tramways Committee was able to show that his department was meeting many such charges out of revenue, or otherwise providing financially for them.

In our last week's issue we under-stated the capital expenditure on the tramways undertaking, which actually amounts to £1,555,186.

Rochdale.—The first year of working of the completed municipal tramways has yielded a net profit of £2,893. This is gratifying to the ratepayers, inasmuch as last year there was a deficit of £434, and in 1905 one of £8,000. The profit this year is to be applied to reduction of debt. The total receipts from the tramways for the past 12 months amounted to £54,138; the working expenses were £29,505. This left a gross profit of £24,633. Out of this there were heavy liabilities to be met in the shape of interest on loans, sinking-fund charges, rent of the Littleborough lines, payment of Heywood's proportion, &c., in all £21,740. The payment to Heywood represents that borough's proportionate share of the receipts, after deducting working expenses. The passengers carried during the year totalled nearly 10 millions. The population served by the undertaking is about 102,000. The car-mileage run was 1,201,364, against 985,705 in the previous year; and the average receipts per car-mile were 10·8d., against 10·2d. The percentage of working expenses to receipts is 55, as compared with 57 a year ago. The energy used amounted to 1,896,278 units, costing £9.165. The capital expenditure on the undertaking, to the end of the financial year, was £343,246. The department has still a small margin before it reaches the limit of its borrowing powers.

Tramway Authorities and Post Office Proposals.—Referring to our note on the above last week, a municipal tramways deputation waited on the Postmaster-General on the 22nd inst. The proceedings were private; but a further conference was suggested, at which some arrangement may be come to.

Transvaal.—Johannesburg.—The returns of the municipal electric tramways for the weeks ending March 16th and 23rd are as follows:—

	March 16th.	March 23rd.
Car-miles	37,049	37,538
Passengers carried	356,299	348,000
Total receipts	£4,621	£4,622
Average receipts per car-mile	2s. 5·93d.	2s. 5·56d.

On March 22nd a collision took place on the Johannesburg electric tramways, owing to swarms of locusts on the rails, which were rendered so very greasy as to interfere with the working of the brakes, resulting in the suspension of the traffic close to Twist Street bridge, and injury to a lady passenger and a tramway inspector, besides wrecking the platform of a car. Later accounts state that there were four cars in collision.

Wimbledon.—It is understood that the tramway deadlock will probably be brought to an end this week. For nearly a year a stretch of line running through Wimbledon has been idle. As work on the Tooting-Wimbledon section is now in an advanced stage, the Wimbledon Council is said to be satisfied, and its consent to the working of the Wimbledon section will, it is understood, be given within the next few days.

TELEGRAPH and TELEPHONE NOTES.

Lewisham.—In connection with the question of the reinstatement of trenches opened by the General Post Office for the purpose of laying underground telegraph lines, the Postmaster-General has informed the B.C. that he is unable to concur in the opinion that the trenches should be reinstated to the kerb or forecourt line, whichever is the nearer, and states that if the trenches are properly restored and punned, and if the soil is allowed to consolidate, a level surface can be maintained when the tar is reinstated. The Highways Committee of the B.C., however, adheres to its recommendation.

Liverpool—Antwerp.—Direct telegraphic communication has been opened between Liverpool and Antwerp.

London—Birmingham.—A new underground cable, carrying 200 wires for telegraphic and telephonic purposes, is being laid between London and Birmingham.

Postal Telegraph Conference.—The annual Conference was held at Bournemouth last week, Mr. F. E. Durrant presiding; about 150 delegates were present. Some dissatisfaction was expressed on the subject of the employment of soldier telegraphists, and resolutions were passed regarding the administration of the postal telegraph and telephone services. Glasgow was chosen as the meeting-place for the next conference.

Spain.—Work is about to be commenced on the establishment of a new direct telephone line between Madrid, Segovia, Valladolid, Palencia, Gijon, Santander and Oviedo.

Steamer Telephones.—The L. & Y. and the L. and N.W. Railway companies have made arrangements for their passenger steamships to be connected with the National Telephone Co.'s system in the north of Ireland, whilst lying at the quay in Belfast.

Tele-Photography.—The *Daily Mail* reports that Prof. Korn has successfully transmitted photographs by telegraph between Berlin and Munich, a distance of 240 miles.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902	
Curacao-Coro, Curacao-La Guayra, Curacao-Maracaibo	Closed.. Jan. 12, 1906	
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Port Arthur-Chifu (Closed)	Mar. 9, 1904	
Garachico-Santa Cruz	July 12, 1906	
Las Palmas-Arecife	Aug. 18, 1906	
New Brunswick-Prince Edward Island	Jan. 9, 1907	
Tenedos-Chio	Feb. 13, 1907	April 17, 1907
Cadiz-Teneriffe	April 10, 1907	
Falmouth-Bilbao	April 15, 1907	April 23, 190
Landlines.		
Puerto-Barrios	Aug. 28, 1902	

Transvaal.—The annual report of the Postmaster-General of the Transvaal for the year ended June 30th, 1906, states that new telephone exchanges have been opened at Klerksdorp and Roodeport, and 11 additional call offices have been opened in various places. The revenue derived from call offices amounted to £1,284. It is expected that all the plant for the new Johannesburg exchange will shortly reach there, and that its installation will be completed during the year, and the underground cables which have been laid will be brought into use, so as to replace the overhead wires in the centre of the town. An alternative "trunk" line has been constructed between Germiston and Springs along the railway route, and another from Johannesburg to Krugersdorp along the wagon road. The telephone service rendered free to the Government was worth £6,724, being £952 more than last year.

The report shows that there are 241 public telegraph offices open in the Colony, of which 120 are postal telegraph offices and 121 railway telegraph offices. There was a decline in revenue amounting to £11,621, caused by the reduction in rates. The total value of Government messages dispatched without payment was £13,275, of which the Army share was £2,147. For the first time since the war the cable service for the whole of South Africa has fallen below the necessary amount of £300,000, and the Department has, therefore, had to pay to the Cable Co. a portion of the subsidy, amounting to £515. A good deal of the falling off is due to the prevailing business depression. In construction work the following additions have been made:—Length of line, 44½ miles; mileage

of wire, 259½; totals to date, line, 2,491; wire, 9,739. The work of placing the main lines in Johannesburg underground has been commenced, cable having been laid for 1,492 yards, containing 44 miles of wire.

Wireless Telegraphy.—The efforts of the Marconi Wireless Telegraph Co. to get a contract with the Australian Federal Government have failed. So far, the Australian Postmaster-General has declined to adopt any system, preferring to wait until further information is obtained regarding the systems now used in other parts of the world.

An agreement has been concluded between the French, British, Spanish and German Governments, regarding wireless telegraphy in Morocco, according to which an international company will be formed, with M. Henri Popp as manager. The capital will be equally divided between the four nationalities, which will each be represented on the board of management.

CONTRACTORS' COLUMN.

Openings for New Business.

ABERDEEN.—Addition to Ferryhill Mills for Messrs. P. Watson & Son.

Additions to Broadford works for Richards, Ltd. Wilson and Walker, architects.

Warehouse for Messrs. Ingram & Mortimer. Watt & Davidson, architects.

BACUP.—School for St. John's Church. H. F. V. Newsome, c/o Radcliffe and Chadwick, architects, 78, King Street, Manchester.

BRADFORD.—Brewery extension. J. D. Wood, 3, Newhall Street, Birmingham.

(Yeadon).—Rebuilding "Old Mills." H. W. Long, architect, 181, New Line, Greengates, Bradford.

BRISTOL.—Rebuilding of Merchant Venturers' Technical College recently destroyed by fire. A. W. S. Cross, M.A., F.R.I.B.A., London, architect.

New branch bank for Wilts & Dorset Banking Co. G. M. Silley, 17, Craven Street, London, W.C., architect.

Residential institution for 100 blind at Westbury-on-Trym to cost £25,000. E. Gabriel, London, architect.

(Westbury Park).—Church (£8,100). Rodway & Denning, architects, Bristol.

BURNLEY.—Parochial hall (St. Margaret's Church). Shaw & Vowles, architects, Mercantile Chambers, Burnley.

BURY (Lancs.).—12 houses and shop for Co-operative Society. W. E. Gill, architect, Derby Chambers, Fleet Street, Bury (Lancs.)

CLIFTON (near Manchester).—New collieries. Clifton & Kersley Coal Co., Clifton, are about to sink new mines at Astley.

CLONMEL (Ireland).—Two consumption hospitals. J. F. Fuller, architect.

COVENTRY.—Alterations and additions to Earlsdon council school. G. & L. Steane, architects.

CROYDON.—Higher elementary school, Tamworth Road (estimated cost, £8,000). Architect not yet appointed.

CWMDARE (near Aberdare).—Calvinistic Methodist Chapel. T. Roderick, architect, Aberdare.

DARLINGTON.—Higher elementary school to be built by the Education Committee.

DEARHAM (Cumberland).—Alterations and additions to Dearham council school. J. Foster, Clerk of Works.

DONCASTER.—Public baths. Borough surveyor.

ECCLES.—Restoration of Eccles Parish Church (£2,000). J. F. Moore, Chadwick Road, Eccles.

New church (about £7,000). J. F. Moore, builder, Chadwick road, Eccles.

New council school (cost £10,000). Mr. Lord, The Red House, Pendleton, Manchester, architect.

EDINBURGH.—Public wash-houses. R. Morham, city architect.

ELLACOMBE (Torquay).—Extensions to Christ Church (£2,797). R. F. Yeo, builder, Torquay.

FARNWORTH.—New council school (£8,000). J. Pomeroy, architect, Bolton. Contractors, Messrs. W. Townson & Son, of Bolton, not Johnson, as stated.

FELIXSTOWE.—Special Subjects Centre for East Suffolk County Education Committee. W. E. Watkins, Secretary, County Hall, Ipswich.

FORFAR.—Extension of South Burgh School (£3,500). J. McLean & Son, builders, Forfar.

GILESGATE MOOR (Durham).—Council School (accom. 400). A. J. Dawson, Clerk to Education Committee.

GLASGOW.—"Glasgow Constitutional Club," with concert hall for 950 persons. Albert Fountain, architect, 68, Gordon Street, Glasgow.

Additions to hotel. Angus Mackay & Co., Buchanan Street.

GOUROCK.—School, £9,295. Alex. Cullen, architect, Brandon Chambers, Hamilton.

HALIFAX.—Large Café and Dining Establishment for G. Whitley & Son, electric light throughout. W. C. Williams, architect.

HANDSWORTH (Staffs.).—Manual workshop, laboratory, cookery and laundry kitchens for the U.D.C. J. P. Osborne, architect, 95, Colmore Row, Birmingham.

HASLINGDEN (Lancashire).—New Council School, Gregory Lane. Haslingden Education Committee.

HUDDERSFIELD (Scissett).—Additions to Cuttlehurst House. John Kirk and Sons, architects, John William Street, Huddersfield.

(Meltham).—Extension of Joint Isolation Hospital. J. Berry, architect, 3, Market Place, Huddersfield.

HULL.—Warehouse and offices (Craven Street). E. Whitlock, architect, 26, Scale Lane, Hull.

ILFRACOMBE.—Post Office in High Street.

LANCASTER.—Extension of Royal Albert Asylum, Lancaster, to be called the "James Diggens Memorial Reception House." Architects, Messrs. Woolfall & Eccles, Liverpool.

LEEDS.—New Synagogue. W. A. Hobson, architect, 41, Albion Street, Leeds.

(Bramley).—Extensions to Bramley Engineering Works. J. A. Webster, architect, 2, Basinghall Square, Basinghall Street, Leeds.

LONDON (Haymarket, W.).—Building in Coventry Street and Rupert Street for Lyons & Co. W. J. Ancell, 3, Staple Inn, W.C., architect.

(Brockley Rise).—Parish Hall. E. Hide & Son, 17, Gracechurch Street, E.C., architects.

(Deptford).—Additions to works of J. Defries & Sons, Ltd., 146-7, Hounsditch, E.

(Lambeth).—Additions to offices of Guardians. W. Thurnall, clerk to guardians, 128, Brook Street, Kennington, S.E.

(Strand).—Offices at East Wharf, Adelphi. Hayward & Maynard, 20, John Street, Adelphi, architects.

(Upper Tooting).—Parochial Hall (seat 400). C. A. Adams, 66, Victoria Street, S.W., architect.

(Hoxton).—Buildings for Tapp & Co., shop-fitters. G. H. Lovegrove, 170, High Street, Shoreditch.

(Silvertown, E.).—New offices for Anglo-American Oil Co., North Woolwich Road, E.

(Stratford, E.).—Additional workshops at Albert Works. W. R. Cooper, 113, Tulse Hill, S.W., consulting engineer.

(Stratford, E.).—Extension of engineering works. Holbrook and Sons, 44, Martin Street, E., engineers.

LOUGH SWILLY (Ireland).—Large Military Barracks.

LOUTH.—Chapel in connection with St. Michael's Church (£1,400).

LYTHAM.—King Edward VII. School (£30,000). W. Eaves & Co., 8, Clifton Street, Blackpool.

MANCHESTER.—Baths and Washhouses at Bradford for the T.C. City Architect, Town Hall, Manchester.

(Stretford).—New Elementary School at Old Trafford, for the Stretford Urban District Council Education Committee.

(Levenshulme).—New Church (St Mark's). C. T. Taylor, architect, 10, Cliff Street, Oldham.

MIDHURST.—Congregational Church (£2,300).

MOUNTAIN ASH.—Cookery school and offices for the U.D.C. W. H. Williams, architect, Town Hall, Mountain Ash.

NEWPORT (Mon.).—Primitive Methodist Schools and Church (£3,200). Newland, Davis & Hunt, architects, 19, Commercial Street, Newport (Mon.); W. R. Pitt, builder, Newport (Mon).

NORWICH.—Buildings in memory of Dr. J. Martineau (£7,000).

NOTTINGHAM (Shirebrook).—Roman Catholic church and priest's house (£2,000).

OLDHAM.—Spinning Mill at Waterhead, by Doris Spinning Co. Write Secretary.

New Cotton Mill (Belgrave Mill). Builders, Messrs. Whitworth, Whittaker & Co.

PORTSMOUTH (Milton).—Laundry at the Infectious Diseases Hospital (£2,189). W. W. Learmouth, contractor, Portsmouth,

REDDITCH.—Club premises for the Union Club, Ltd. J. Johnson, architect, Redditch.

ST. DAVID'S (Wales).—Laboratory, workshop, and cookery room at county school. H. Thomas, architect, 9, Victoria Place, Haverford West.

SALFORD (Halton Bank).—New public school and caretaker's house (£16,113). J. Ramsbottom, builder, Pendleton, Salford.

SOUTHEND-ON-SEA.—Operating theatre at the Victoria Hospital. Southend Hospital Committee.

SWINDON (Wilts).—New Church, St. Augustine's (£3,100). W. A. H. Masters, architect, 1, Regent Circus, Swindon; H. & C. Spackman, builders, Hunt Street, Swindon.

Wesleyan Mission Hall (£8,000). W. F. Bird, architect, Midsomer Norton; Tydeman Bros., builders, Edgware Road, Swindon.

TEDDINGTON.—Town Hall. G. H. Salmons, Clerk to the Council.

TOLSWORTH.—Extension of hospital. W. H. Woodroffe, 32, High Street, Borough, S.E., architect.

TREORKY.—Alterations at Conservative Club. J. Rees, architect.

YSTRAD RHONDDA.—Alterations to premises in William Street for Ystrad Rhondda Conservative Club. W. D. Morgan, Post Office Chambers, Penttee, architect.

Electrical Duties at Devonport Dockyard.—A correspondent writes:—"The development which has taken place in electrical science, and its general application in the Government Dockyard at Devonport, has led to an over-lapping of responsibility and duties between the electrical engineer's and the constructive and engineering managers' departments. The first-named department consists of a central office at the Admiralty and branches at the Dockyard, and was inaugurated to deal with electrical fittings and equipment generally, differentiating between work and responsibility purely electrical and that of the two other departments referred to. The electrical department has, on the whole, justified its existence, but during the course of the electrical development the work has been in charge of successive assistant constructors, the electrical fitters and other workmen employed being part of their staff, and hence the piercing of bulkheads and protective decks for the running of circuits and the fixing of motors, dynamos and instruments has been carried out by them without risk, owing to the head of the department being responsible for the hull. When, however, the transfer of duties took place, the electrical engineer not only assumed responsibility for the electrical equipment, but also continued the system under which his men performed the work of electrical fitters, but of ship-fitters and shipwrights also, and that of joiners occasionally thrown in, although the responsibility for the strength and watertightness of the portions of the hull operated on by his men continued to be vested in the constructive manager. The increase in electrical appliances both ashore and afloat has drawn special attention to the matter, and the Admiralty has now issued special instructions, defining the duties and responsibilities of the respective departments."

Fire at Widnes.—The *Daily News* reports that on Saturday afternoon last the Dolphine patent process plant at Messrs. Bolton's silver and copper works, Widnes, was totally destroyed by fire. The plant was quite recently erected for the purpose of extracting silver from bluestone. The Atlas works of the United Alkali Co. were saved by the brigade. The total damage is said to approach £40,000.

ELECTRIC POWER IN DURHAM COLLIERIES.

To assert that electricity has become absolutely indispensable to the profitable working of a colliery would certainly invite a storm of negation from advocates of steam and compressed air, and also, it must be admitted, from some other authorities who may lay better claim to impartiality: but the very fact that such a claim should be put forward at all is significant of the great progress which has been made in the practical application of electricity underground. Various reasons have been, and are, given for the ever-widening adoption of electricity, but all may be summarised in the plain statement that "it pays," and as pits grow deeper and workings more extensive, while electrical plant grows cheaper and more reliable, it pays more and more, so that already electrification has become a commercial necessity in many pits, and will soon do so in most, if not in all.

Of the many groups of collieries in the Durham district, none are better known than the Lambton Pits. Though experiments in electrical working on a small scale have been in progress at these pits for a long time past, complete electrification was only decided upon recently. An agreement was made with the Durham Collieries Electric Power Supply Co. for the supply of the power required, on advantageous terms, and thus the need for a private generating station was dispensed with. The electrical plant at both the colliery and the power station came into operation last summer, and have been in regular service since.

As the power station is an excellent example of its kind, we may preface the description of the colliery plant proper,

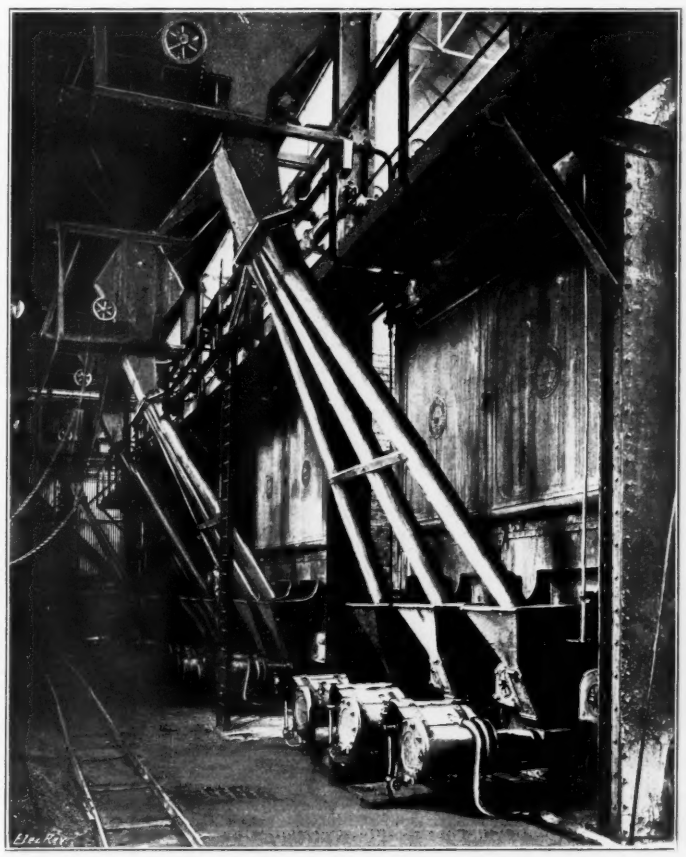


Fig. 1.—View in the Boiler House, Durham Collieries Electric Power Co.'s Station.

with some details of the power house equipment.

The station is located close to the village of Philadelphia, Co. Durham, and adjoins the carshed of the Sunderland District Tramways. It is about equi-distant from Fencehouses and Penshaw stations on the N.E. Railway, and direct rail facilities are provided by the private line of the Lambton Collieries. Water is a more difficult problem than coal, and there being a scarcity in the immediate neighbour-

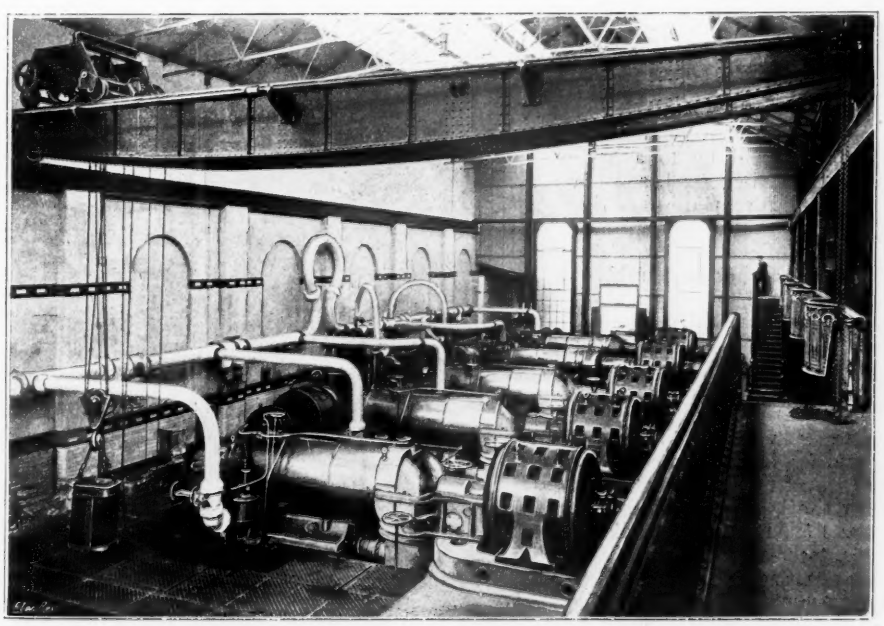
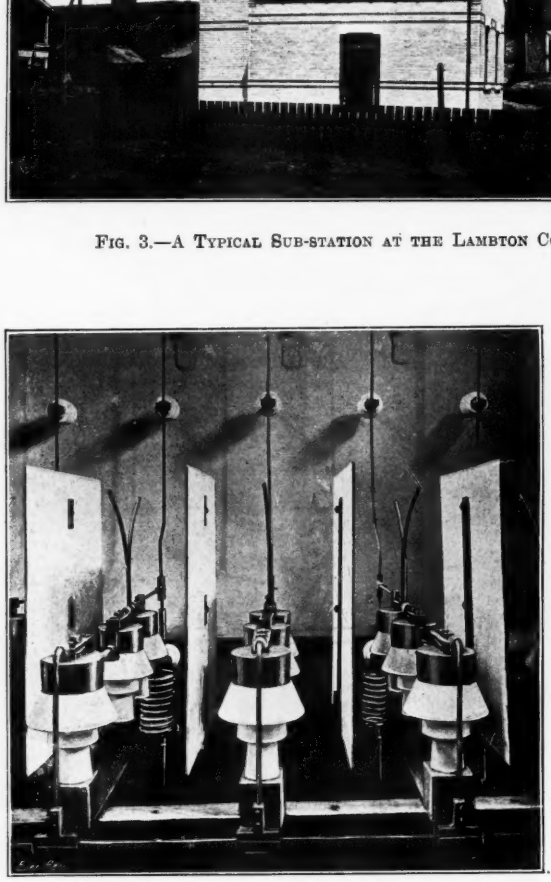


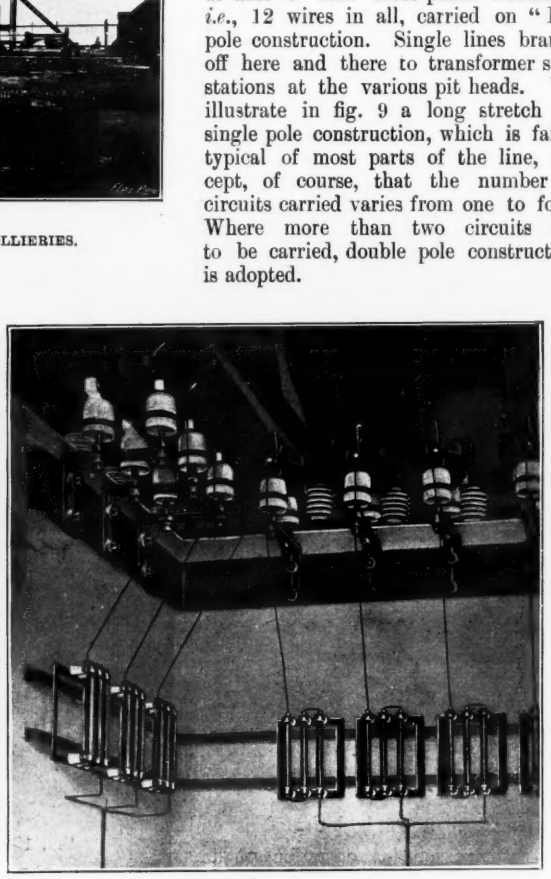
Fig. 2.—Parsons-Peebles Turbo-generating Plant, Durham Collieries Electric Power Co.'s Station.

Fig. 3.—A Typical Sub-station at the Lambton Collieries.

Sunderland District Tramways through a sub-station arranged in a corner of the power house, and equipped with two 500-kw. Peebles-La Cour motor-converters, which deliver direct current at 500 volts pressure for tramway purposes.

The transmission line from the power house to the Lambton Collieries is a good example of modern overhead high-tension transmission. It consists at first of four three-phase circuits—*i.e.*, 12 wires in all, carried on "H" pole construction. Single lines branch off here and there to transformer sub-stations at the various pit heads. We illustrate in fig. 9 a long stretch of single pole construction, which is fairly typical of most parts of the line, except, of course, that the number of circuits carried varies from one to four. Where more than two circuits are to be carried, double pole construction is adopted.





Figs. 4 and 5.—Types of Lightning Arresters in Sub-station.

hood, a pipe line has been run to the river, two miles away, and a motor-driven pumping station, electrically controlled from the power station, has been installed by the water side. Here two 80-b.h.p. totally enclosed Peebles induction motors are installed, driving Gwynne centrifugal pumps, either set being large enough to supply water for the station under full load. The water is pumped up to a large storage reservoir, distinct from the cooling pond, and the make-up water for the cooling pond is supplied from this reservoir.

The boiler house, illustrated in fig. 1, contains five large Babcock & Wilcox boilers (*i.e.*, one for each turbine), fired by Erith's underfeed stokers. The steam piping is very simply arranged, there being a main header sectioned by valves, and steam pipes are "teed" off to the boilers and turbines respectively; and any one boiler and turbine may be run as an independent unit if desired, or a damaged length of piping cut out.

The turbines, like the boilers, are five in number, three of them having been manufactured for Messrs. Bruce Peebles and Co. (who were the main contractors for the station), by Messrs. Parsons, and the other two by Messrs. Willans and Robinson. The turbines run at 1,500 r.p.m., and are direct-coupled to Peebles 1,550-k.v.a. turbo-alternators, as shown in our view, fig. 2, of the generating units. The latter generate three-phase current at 6,600 volts and 50 cycles for distribution, mainly by overhead transmission lines, to various neighbouring pits. A supply is also given to the

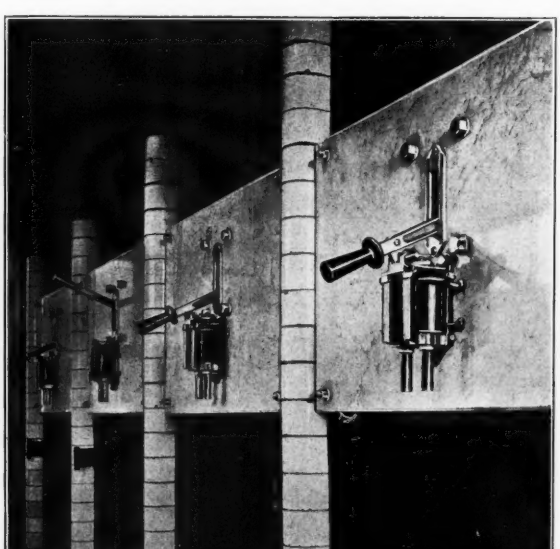


Fig. 6.—H.T. Panels in Sub-station.

The poles used in the line construction measure from 36 ft. to 48 ft. in overall length, by approximately 9 in. diameter, and are sunk from 6 to 8 ft. in the ground, according to length. The minimum height of the transmission lines at the ground level is 21 ft., and the maximum, which occurs at the point at which the transmission line crosses over the Sunderland District Tramways, is 36 ft. clear from the ground. As will be seen, the transmission lines are enclosed throughout in a strong guard net, which is supported by heavy harp-shaped iron brackets mounted on the poles. The longitudinal wires of the guard nets are No. 8 galvanised steel, and the locket wire is No. 14 iron. The guard net is, of course, earthed at both ends and at frequent points of its length, so that if a transmission line should break, the latter would be earthed immediately and thus rendered harmless.

Precautions are also taken to prevent unauthorised persons from climbing the poles, spirals of barbed wire being wound round them for this purpose.

The main Lambton transmission line is constructed in three sections, special terminal poles, one of which is shown in fig. 8, being provided at the end of each, so that the line may be disconnected at these points if necessary. Near each pit there is a sub-station (fig. 3), which contains high and low-tension switches, lightning arresters, transformers, &c. In some cases, however, current is taken down the pit direct at 6,500 volts, and undergoes no transformation above ground. In such cases the sub-station simply forms a distribution station, controlling the various cables running down the pits, though it is generally equipped, also with a small transformer for supplying lighting in the neighbourhood.

The fact that the high-tension mains are brought in overhead, lends itself to a very nice design of sub-station. As will be seen from the illustrations, the high-tension leads enter the tower through circular holes in heavy panes of glass, and the strain is taken up on shackle insulators just inside the tower. The leads then pass downwards (and connect to horn type lightning arresters with carbon resistances and choke coils, as shown in fig. 4), to the point where they couple up to the H.T. bus-bars, which are carried on heavy insulators above the switch panels (shown in fig. 6); from these buses, connections pass down to the main oil switches in the fireproof compartments beneath, and thence to the H.T. side of the transformer. In some cases, however, outgoing H.T. feeders, either overhead or underground have to be connected up to the H.T. bus-bars, and in such cases, a H.T. oil switch is, of course, provided on the outgoing feeder, together with the necessary disconnecting link switch. When the outgoing feeder is overhead, lightning arresters of the horn type are provided.

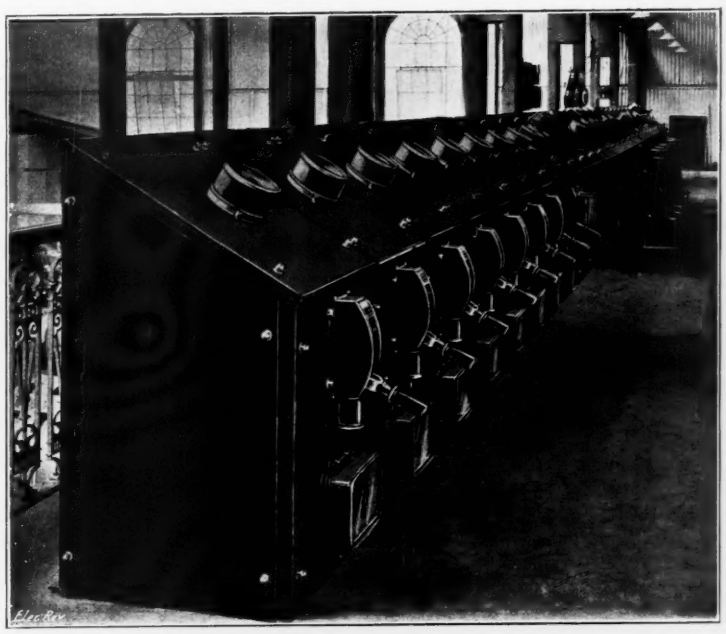


Fig. 7.—Bench Type Switchboard, Durham Collieries Power Station.

The low-tension side of the sub-station follows standard practice, oil switches with overload release being fitted to each feeder, together with the necessary instruments.

Before turning our attention to the motor equipment underground, mention must be made of the cable work. The cables down the shafts and in the workings were supplied by various manufacturers, including Messrs. Callenders, the British Insulated and Helsby Cables, and Messrs. W. T. Glover & Co., all as sub-contractors to Messrs. Bruce Peebles; they are mostly of the lead-covered type, with double wire armoured cores, paper insulated and fixed in the shaft by means of long wooden cleats, bolted to channel irons let into the walls. In the case of the workings they are suspended from the props by means of wooden hold-fasts or by tarred rope slings, which will break and allow the cable to drop uninjured in case of a fall of roof.

Fig. 8.—Terminal Pole, Colliery Transmission Line.

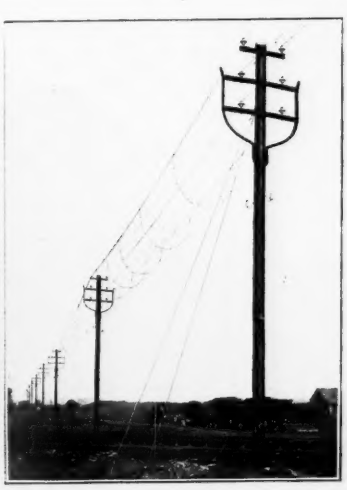


Fig. 9.—View of the Lambton Collieries Transmission Line.

As will be inferred from the foregoing remarks, there are several sub-stations underground in addition to those on the surface; for instance, at the "D" pit, three high-tension cables and one low-tension are carried underground direct from the surface sub-station, the high-tension cables running to four sub-stations in the workings.

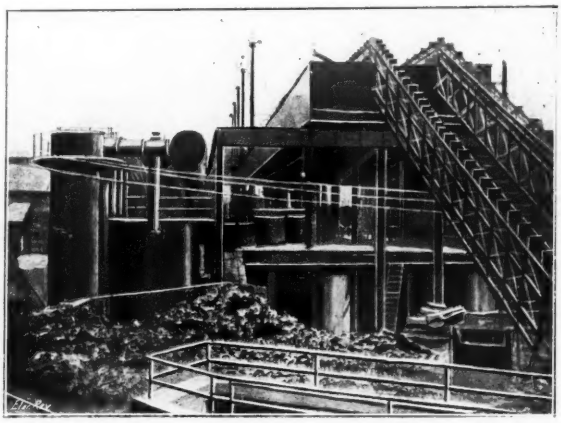
(*To be concluded.*)

JOHANNESBURG TRAMWAY MATTERS.

Our Johannesburg correspondent writes that a lively altercation occurred at a T.C. meeting in Johannesburg on March 27th, between Mr. Julius Jeppe, chairman of the Tramway Committee, and Mr. C. A. Lane, who had asked a series of questions relative to the tramway system, which has lately been giving so much trouble and anxiety.

It appears that Mr. Lane was accused of giving away confidential information to the local Press, which Mr. Lane vigorously repudiated. The Committee felt it was not in the public interest that any statement of tramway matters be yet made public.

On the following day, March 23rd, the most serious stoppage which has yet taken place in connection with the tramway system occurred.

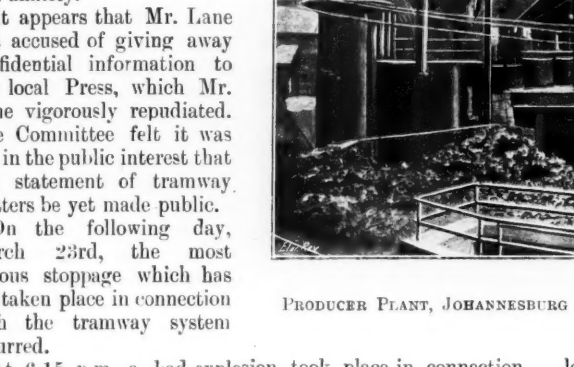


Producer Plant, Johannesburg Municipal Power Station.

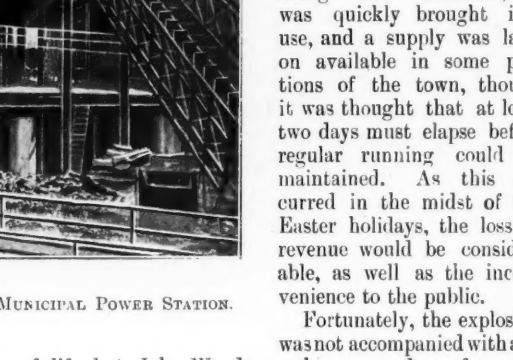
At 6.15 p.m. a bad explosion took place in connection with the producer gas plant, through the back firing of the gas from the producers to the air delivery pipes, the actual explosion taking place inside the "Roots" air blowers, completely shattering the cast-iron cases. The explosion lifted a portion of the roof, and damaged the external walls. Two blowers only, out of the four, were damaged, though all four were inter-connected, but fortunately the main valves of the main air pipe were uninjured. Those, however, on the undamaged blowers were injured through the force of the explosion. As a consequence, the whole of the plant was put out of use, the tramway system being completely brought to a standstill, as well as nearly the whole of the lighting of the town. A portion of the old steam plant being still available, it was quickly brought into use, and a supply was later on available in some portions of the town, though it was thought that at least two days must elapse before regular running could be maintained. As this occurred in the midst of the Easter holidays, the loss in revenue would be considerable, as well as the inconvenience to the public.

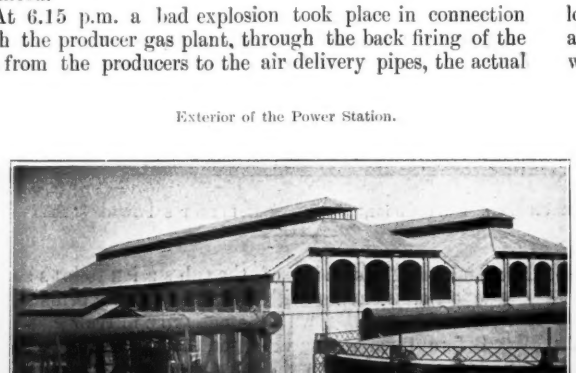
Fortunately, the explosion was not accompanied with any loss of life, but John Woodman, the gas producer foreman, and H. A. Finlayson, electrican, were badly injured, and were sent to the hospital for treatment. The illustrations of some portions of the work in progress, taken last August, will be of interest; the blower house in question will be seen on the left of one of the figures.

Exterior of the Power Station.

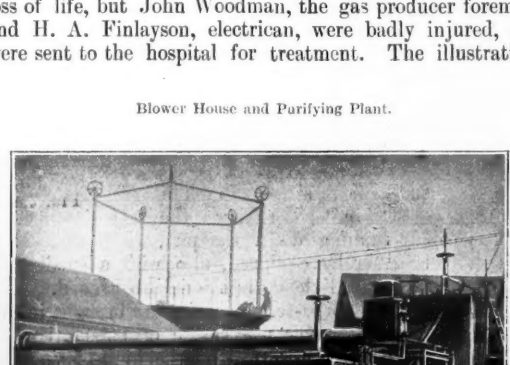


Blower House and Purifying Plant.





Scrubbers and Gasholder.



The Car Shed.

The Johannesburg Municipal Tramways and Lighting Plant.

CONTRACTS OPEN and CLOSED.

OPEN.

Antwerp.—May 6th. The municipal authorities of this city invite tenders for the supply of electric lift and crane appliances. The specification may be obtained from the Hotel de Ville, at Antwerp. Tenders, in sealed registered envelopes, should be delivered to "M. le Bourgmestre de la Ville," at the Hotel de Ville. Deposit 3,000 francs (about £120). Specification at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

Aston Manor.—May 11th. High and low-tension three-phase cables for lighting supply to Erdington U.D. See "Official Notices" to-day.

Austria.—May 7th. The Austrian State Railway authorities in Cracow are inviting tenders until May 7th for an installation of a complete electric lighting plant at the railway workshops at Neusander.

Barnes.—May 14th. Steam, exhaust and other piping for the electricity works. See "Official Notices" to-day.

Belgium.—May 4th. The municipal authorities of Tongres are inviting tenders for the establishment of a central electric lighting station in the town. Particulars may be obtained for 10 francs from, and tenders are to be sent to, Le Collège Echevinal, Hotel de Ville, Tongres.

Belgium.—May 6th. The Provincial Government at Liége requires tenders for the construction, maintenance, and exploitation of an electric tramway from the railway station at Spa to the Hippodrome, which is to be built at La Longue Reid, and the construction of a branch line to the Forester's house at Theus. A deposit of £800 is required. Registered tenders must be sent in by May 2nd.

Belgium.—May 18th. The municipal authorities of Brussels are inviting tenders for the supply and erection at the gas works, of four static transformers, two 60-K.V.A. alternators, 18 synchronised motors, &c. Particulars may be obtained from, and tenders are to be sent to, Le College des Bourgmestre et Echevins, Hotel de Ville, Brussels.

Bristol.—May 20th. A.C. and D.C. flame arc lamps for the Corporation. See "Official Notices" to-day.

Cardiff.—April 26th. Extra-high-tension three-phase feeder cable and switchboard for the Corporation. See "Official Notices" April 19th.

Croydon.—May 6th. Boiler feed pipe-work and new flue and economiser setting at the Council's electricity works. See "Official Notices" to-day.

Gravesend.—May 10th. Cables, battery, balancer and booster, and switchboard for the Electricity Committee. See "Official Notices" to-day.

Harrogate.—April 30th. Electric light wiring and fittings for the Grove Road council school. Specifications from the Electricity Department, 33, Swan Road.

Islington.—May 8th. Electrically-driven fan for the Lighting Committee. See "Official Notices" April 12th.

Kirkcaldy.—May 4th. Boiler feed pump (3,000 gals. per hour) for the Corporation Electricity Works. See "Official Notices" April 19th.

L.C.C.—April 30th. Nine electrically-driven ventilating fans at the Central School of Arts and Crafts and the London Day Training College, Southampton Row, London. See "Official Notices" April 19th.

L.C.C.—May 7th and June 11th. Six fuel economisers for East Greenwich tramways generating station; high and low-tension switchgear for five tramway sub-stations. See "Official Notices" to-day.

Malvern.—April 29th. Various materials for the U.D.C. Electricity Department. See "Official Notices" April 19th.

Malines.—May 6th. Tenders are required for an installation to repair and charge electric accumulators. The estimate is £412, and a deposit of £136 is required. Particulars, Specification No. 64, 1907, may be obtained for 4d. from Mr. Slaghmuylder, 1, Rue de Brabant, Brussels.

Melbourne (Victoria).—May 7th. Tenders will be received at the office of the Deputy Postmaster-General, Melbourne, for the supply and delivery at Melbourne of two telephone switchboards. See this column in our April 5th issue.

Paris.—May 16th. Tenders will be opened on May 16th, at 1.30 p.m., by the Prefect of the Department de la Seine for the maintenance and working of the electricity station at Prison de la Santé for six years. Application must be made before April 29th.

Pembroke.—May 4th. High speed engine, D.C. dynamo, switchboard and instruments, accumulators, boiler, arc lamps and gear, arc lamp-posts for the U.D.C. See "Official Notices" April 19th.

Portsmouth.—April 26th. Electrical wiring and fittings for the Municipal Institute and Free Library. See "Official Notices" April 5th.

Shanghai.—May 4th. One 800-KW. horizontal steam turbo-alternator (single-phase), with condensing plant, for the Municipal Council. See "Official Notices" April 12th.

Sophia.—May 10th. The Postmaster-General requires tenders for 14,000 kilogrammes of bimetallic wire, of 3 mm. diameter; of 2,000 kilogrammes of 2 mm. diameter, for branching; 3,000 kilogrammes of 1½ mm. diameter; and 500 kilogrammes of 1½ mm. diameter, for branching. The estimate is £12,000, and a deposit of 5 per cent. is required. Tenders are to be addressed to the Secretaire de l'Administration des Finances du district.

South Australia.—June 12th. The Postmaster-General requires tenders for 500 Meidinger line cells; 500 Meidinger line cups; 5,000 Meidinger line corks and tubes; 6,000 Meidinger line zincs; 6 tons of sulphate of magnesia; and 7 tons of crushed sal-ammoniac.

Southport.—May 2nd. Advertising on Corporation tramcars. See "Official Notices" April 19th.

St. Pancras.—May 13th. Arc lamp carbons for the Council. See "Official Notices" to-day.

Turkey.—The Turkish Ministry of Public Works in Constantinople is inviting tenders for the establishment of a central station in Salonica, for the electric lighting of the town, and for the operation of an electric tramway.

Walthamstow.—May 3rd. Stores for the electricity and tramway departments. See "Official Notices" to-day.

Warrington.—May 7th. Six tramcar top-covers for the Corporation. See "Official Notices" to-day.

Woolwich.—May 1st. Additions to the electric lighting installation at the Plumstead infirmary for the Woolwich guardians. Specifications (two guineas) from the Clerk to the Guardians.

Wolverhampton.—May 2nd. Boilers, economiser, feed pumps, steel chimney and feed-water tank; also turbo-alternator sets and condensing plant for the Electricity Committee. See "Official Notices" April 19th.

Yokohama.—The Government of Japan has decided to obtain 31 electric cranes, of a capacity of from 1 to 75 tons each, and of two of 30 tons each, for the quays of the port.

CLOSED.

Bristol.—The contract for motors and starters for the Corporation has been placed with Messrs. Veritys, Ltd.

London.—BATTERSEA.—The B.C. has accepted the tender of Callender's Cable & Construction Co. to purchase scrap copper from the generating station, at the rate of £108 per ton.

FULHAM.—The B.C. has accepted the tender of Kaye & Sons to supply during the year for the generating station 2,000 tons of "Bedworth Peas," at 8s. 5d. per ton, delivered alongside the Council's wharf. The question of obtaining two additional under-feed stokers for the boiler house of the generating station is under consideration.

L.C.C.—The following tenders have been received by the L.C.C. for the supply of eight travelling hand cranes for use at various tramway sub-stations:—

Carl Flohr	(not to specification)	£1,346
T. Larmuth & Co.	(recommended)	1,427
" "	(alternative tender)	1,435
Thomas Broadbent & Sons	(alternative tender)	1,545
S. H. Heywood		1,579
Thomas Broadbent & Sons		1,598
Carrick & Ritchie	(alternative tender)	1,669
James Spencer & Co.		1,669
John M. Henderson & Co.		1,685
Applebys, Ltd.		1,746
Carrick & Ritchie		1,789
Adamson, Ramsbottom & Co.		1,870
Carl Flohr	(alternative tender)	1,964
B. Johnson & Son		1,995
Pickerings, Ltd.		2,253
Butters Bros. & Co.		2,635

The tender of the Hadfield Steel Foundry Co., amounting to £2,875, is recommended for acceptance for the special track-work required for renewals of the permanent way at the Elephant and Castle. The Lorain Steel Co., of America, tendered for the work, at £2,650.

Manchester.—The order for the ½, 1 and 2-H.P. size motors for the Corporation contract has been placed with Messrs. Veritys, Ltd., for their new B.P. machines.

Preston.—The Tramway Committee of the T.C. has accepted the tender of the United Electric Car Co., of Preston, for the supply of 10 top-deck covers for cars, at £120 each.

Salford.—The order for the high and low-speed motors up to 5 and 3 H.P. respectively for the Corporation contract has been placed with Messrs. Veritys, Ltd., for their new B.P. machines.

West Suffolk.—The Standing Joint Committee has accepted the tender of Messrs. Faraday & Son, of London, for the supply of special electric light fittings for the Shire Hall, at £100, and that of Messrs. Higgins & Griffiths, of London, for electric cover plates, at £13 13s.

FORTHCOMING EVENTS.

To-day's Events (Friday, April 26th).—At 9 p.m. Royal Institution of Great Britain. Discourse by Mr. James Swinburne, F.R.S., on "New Illuminants."

Saturday, April 27th.—At 3 p.m. Royal Institution of Great Britain. Prof. S. P. Thompson, F.R.S., on "Studies in Magnetism." (Tyndall Lecture III.)

At 10 a.m. Institution of Electrical Engineers (Students). Visit to National Physical Laboratory, Teddington. Meet at Laboratory. Apply E. W. Moss, 20, Huddleston Road, Tufnell Park, N.

Tuesday, April 30th.—At 8 p.m. Annual general meeting of the Institution of Civil Engineers (Corporate Members only).

Wednesday, May 1st.- At 5 p.m. Annual meeting of the Royal Institution of Great Britain, Albemarle Street, Piccadilly, W.

At 7.30 p.m. Institution of Electrical Engineers (Students). Meeting at 92, Victoria Street, S.W. Annual general meeting. Paper on "Electric Valves," by E. W. Moss (student).

Thursday, May 2nd.—At 8 p.m. Institution of Electrical Engineers. At the Society of Arts, John Street, Adelphi, W.C. In the event of the discussion on Mr. Hammond's paper being concluded at the meeting of April 25th, the following paper will be read:—"The Use of Wooden Poles for Overhead Power Transmission," by C. Wade.

At 8.30 p.m. Chemical Society. Ordinary meeting at Burlington House, Piccadilly.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, April 29th.—"A" Company, infantry drill, 6.30 p.m.
Tuesday, April 30th.—"B" Company, infantry drill, 8 p.m.
Thursday, May 2nd.—"C" Company, infantry drill, 7.30 p.m.
Friday, May 3rd.—"D" Company, infantry drill, 7 p.m.

J. H. S. Phillips, Captain, for Adjutant on leave,
Electrical Engineers R.E (V.).

NOTES.

To our Readers.—If any reader should find difficulty in getting the Electrical Review delivered, we shall be greatly obliged if he will communicate direct with our Manager, at 4, Ludgate Hill, London, stating the name and address of the agent who fails to supply.

J. B. Saunders & Co.'s 50th Anniversary Celebration.—A very elegant dinner was given by the above firm on Wednesday last, about sixty old friends and business acquaintances being invited. The Whamcliffe room of the Hotel Great Central was beautifully decorated for the occasion, and a very agreeable evening was spent. After the usual loyal toast had been given by Mr. W. H. R. Saunders, Sir James Szlumper proposed the toast of "The Firm"; he was ably seconded in a vigorous speech by Mr. C. Lundie, who bears his ninety-two years of life most wonderfully. The whole of these speeches, and of the comments made by the guests in conversation, testified to the respect in which the firm is held, and one heard on all sides of its reliability in business and good faith in all its transactions. Mr. W. H. R. Saunders and his partners, Mr. J. H. P. Berthon and Mr. S. G. Leech suitably responded. We join in wishing all prosperity and success during the next fifty years to Messrs. J. B. Saunders & Co.

It may be interesting to our readers to add that the firm of J. B. Saunders & Co. was established by the late Mr. John Brewer Saunders in 1857. Mr. Saunders was formerly the Electric and International Co.'s engineer for the Western and South Wales districts, and upon the telegraph companies' interests being purchased and taken over by the Post Office, Mr. Saunders took a prominent part in the arbitration under which the sums to be paid to various railway companies in respect of telegraph rights were decided. He received a pension from the Government for his service under the old company, and then devoted his entire energy to the development of his firm's business. In 1860 Mr. Saunders patented a very important improvement in railway block telegraph working, and it was installed on several lines, and was in work until the introduction of the more elaborate train tablet and train staff systems. The firm were the first to introduce the telephone in South Wales, and have during the past 25 years carried out many important installations on several of the leading railways. They have also completed numerous electric light contracts on a large scale, amongst them being the lighting of Penarth Docks, Barrow-in-Furness Docks, the Admiralty Buildings at Pembroke Dock, Cardiff Post Office, &c.

It is in railway telegraphs that we find the firm's most important work. They have equipped no fewer than 45 lines of railway with complete block telegraphs, including the necessary telegraph and telephone systems, and during the past 50 years no less than 2,000 miles of lines, carrying upwards of 10,000 miles of wire, have been constructed. A very large portion of these lines are maintained for railway companies and others by the firm, who have at the present moment about 1,400 miles of lines, embracing no less than 6,750 miles of wire, and 4,200 instruments of various types, in addition to several important lighting and power plants, under their charge.

Mr. J. B. Saunders retired in 1893, and died in June, 1895. The present senior partner, Mr. W. H. R. Saunders joined the firm in 1874. The business having so largely developed, it was found necessary to reconstruct it, and in 1904 Mr. J. H. P. Berthon, who had assisted Mr. Saunders for several years, and Mr. S. G. Leech, M.I.E.E., who had considerable experience with the Brush and British Electric Traction Companies, were taken into partnership. Messrs. J. B. Saunders & Co. employ a large number of skilled hands, the majority of whom have served their apprenticeship with the firm, and amongst the present staff may be mentioned Mr. H. D. Thomson, their manager at Cardiff, a most valued member, who has been with them since 1860; Mr. H. Lloyd, their North Wales Inspector, whose term of service exceeds 47 years, and who has been with the firm since boyhood; Messrs. H. Dallimore and H. Niblett, inspectors at Cardiff, whose terms of service reach 32 and 23 years respectively; Mr. W. Fleming, their inspector in the North of England; Mr. W. Wadham, their district inspector at Swindon, both of whom have also served many years, and a number of foremen, linemen and others who can count from 23 to 36 years service, so that counting Mr. Saunders, we find seven members whose term of service with the firm average exactly 33 years.

During the last few days the Corporation of Carmarthen have accepted Messrs. J. B. Saunders & Co.'s offer for the complete lighting of the town for a period of years.

Electric Cars Destroyed by Fire in Australia.—A Sydney correspondent writes:—"Early on the morning of Thursday, March 7th, a car-barn of the St. Kilda, Brighton, electric tramway was destroyed by fire, the damage being estimated at some £15,000. Seventeen cars were completely destroyed, and the building gutted. Fortunately the power house adjoining was saved. The idea of getting the cars out of the burning building does not appear to have occurred to anyone until it was too late. The origin of the fire is at present unknown. All that appears to be tolerably certain is that it originated in the offices, which are situated in the centre of the building. There was a night watchman on the premises, and another employé was also sleeping on the premises at the time, and a third man left the building half an hour before the fire was observed. It is anticipated that some of the trucks will be found serviceable, and the motor frames and gearing are capable of being repaired. In the meantime, the Railway Commissioners have arranged for a service of motor-omnibuses, six of these having been laid by for the past year after a somewhat unsatisfactory service on the Malvern-Prahran route. An attempt is being made to obtain some spare motors from Sydney, and spare cars from the Elsternwick line. As there was no insurance, the loss will be heavy, and there is also the loss of revenue to take into account. During the six months ending December 31st, the gross takings amounted to £4,502, the gross profit amounting to £1,551. During the summer months heavier takings were the rule. January showing £1,436, and February £1,200. The St. Kilda line is a feeder to the Melbourne suburban railway service."

Trade and Technical Papers in Canada.—Openings for British Electrical Goods.—On Wednesday next (May 1st) cheaper postal rates for newspapers between the United Kingdom and Canada will come into force. One of the main objects, if not the main object, of the reform is to encourage the introduction of British trade and technical journals into the Dominion, and thus tend to increase the exports from this country. This point was made clear by Mr. W. L. Griffith, secretary to the High Commissioner for Canada (Lord Strathcona), in an interview with a Press representative last week: "I am confident," he said, "that the reduction of the postal rates will have a material effect on the trade between Canada and Great Britain, and this has been the view taken by the Dominion Postmaster-General (Mr. Le Mieux), one of the most promising of the new school of young French-Canadian statesmen, and he is most enthusiastic in the matter. The

rate is now 4d. per lb. on British trade and technical papers, while American papers are able to enter at ½d. per lb. The enormous advantage this gives to American manufacturers is obvious. But this is not all. What happens is that certain British trade and technical journals have a large sale in Canada, but they enter the Dominion *via* New York, and on their way American advertisements are often substituted for British advertisements. Under the new rate British trade and technical papers will come into Canada at 1d. per lb., and the rates for American newspapers are to be levelled up to the same figure. British trade papers will thus in the future be able to enter Canada with their British advertisements intact, and British goods will be brought directly under the notice of Canadian business men. This, there cannot be the slightest doubt, will tend in a marked degree to increase British trade."

It was further pointed out that in Australia, which at present gives no preference to Great Britain, out of a total importation of electrical goods last year, amounting to £205,726, no less than £141,484 were of British origin, while only £18,844 came from the United States. Out of a total importation of electrical machinery to the amount of £213,352, £136,749 came from the United Kingdom, and only £48,050 from the United States. The following figures (supplied by Mr. Griffith from official returns) showing the importation into Canada, with a preference for British goods of 33⅓ per cent., are in marked contrast with the foregoing, and show that there is a wide field in the Dominion for development by British manufacturers and dealers in electrical goods and machinery:—Electrical articles imported into Canada during 1906, together with the general duty charged upon them, British exporters being allowed a reduction of 33⅓ per cent. on this duty. The figures in each case denote dollars:—Bells, &c. (30 per cent.), Great Britain, 1,166; U.S.A., 35,505; Germany, 868; total imports, 38,667 from all countries. Electric light carbons, carbon points of all kinds, N.E.S. (35 per cent.), U.S.A., 38,597; Germany, 7,180; total imports, 48,064. Electric apparatus, N.E.S. insulators of all kinds, &c, electro-galvanic batteries, telegraphic and telephone instruments (27½ per cent.), Great Britain, 68,717; U.S.A., 2,369,517; Germany, 8,438; France, 7,579; total imports, 2,461,720. Electric motors, generators, dynamos and sockets of all kinds (27½ per cent.), Great Britain, 12,583; U.S.A., 982,999; total imports, 1,003.853. Bulbs for electric light (30 per cent.), Great Britain, 16; U.S.A., 38,254; Austria-Hungary, 1,874; total imports, 40,609.

Islington Electrical Supply.—According to an Islington newspaper, the Islington Borough Council was summoned at the North London Police Court last week for failing to supply sufficient electrical power to one of its consumers. The complainants are manufacturers of electrical machinery, and take the supply of electrical energy to drive their machinery at Northampton Grove, Islington. Mr. Stephen Lynch was counsel for the complainants, and Mr. A. M. Bramall defended. The allegations were that the quantity of power had diminished, this being attributed to a defective cable, and it was admitted that it was the duty of the Borough Council to supply proper cables. In fact, a new cable had been laid, and could be connected in an hour. But there was a technical point in this case, because (Mr. Bramall said) it was not competent for a consumer to make a complaint such as this until he had got an official inspection and report. Besides, the complainants had not stated the maximum of their requirements, though they had been asked; and it was not admitted that the supply had in any way diminished since the complainants had been on the list of consumers. Mr. Lynch: The Borough Council have declared that they supply up to 200 volts, and we have proof that such has not been given to us. Mr. Fordham said he would need proof that the consumer gave notice to the undertakers as to the quantity required, and that the undertakers declared to the consumers their constant pressure. The case was adjourned.

The Electro-Harmonic Society and a New York Engineering "Smoker."—During the progress of the last concert of the Electro-Harmonic Society for this season, held on Friday last, Major O'Meara, who was in the chair, announced that the following cablegram had been dispatched to New York:—

"Doctor Raymond,
"29, West Thirty-Ninth Street, New York.

"While holding the last concert of their twenty-first season this Friday evening, the 470 members and friends of the Electro-Harmonic Society, of London, under the chairmanship of Major O'Meara, the newly-appointed Engineer-in-Chief of the General Post Office, send cordial greetings to those attending the informal smoker arranged for the same evening in connection with the formal inauguration of the United Engineering Building. *Floreat.* May the fumes of our tobacco be wafted West and commingle with yours on this auspicious occasion."

Tramway Festivity.—The Liverpool Tramway Employés' Social, Athletic and Thrift Society held its annual tea, concert and dance last week, on the Thursday evening, upwards of 1,600 people assembling at St. George's Hall. The arrangements were repeated on the following evening for the benefit of employés who were unable to be present on Thursday night. The chair was taken by Sir Charles Petrie, who was accompanied by Lady Petrie.

Institution and Lecture Notes.—Institution of Electrical Engineers (Manchester Students).—The report of the Students' Section states that during the third session eight meetings and eight visits to works have taken place. The section has 313 members. The two Schwartz premiums of two guineas and one guinea respectively were awarded to Mr. W. Browning for his paper, "Some Notes on Electrical Conductivity;" and to Mr. F. Shaw, for his paper on "Electric Lamps." A premium of £5 was also awarded to Mr. W. Browning by the Council of the Institution for his paper.

Royal United Service Institution.—On Wednesday last week, Mr. C. Bright delivered a lecture on "Submarine Telegraphy," illustrated with lantern slides and experimental apparatus.

University College Students' Dinner.—At the dinner of the Past and Present Engineering Students of University College, London, the following among others are expected to be present:—Sir Alex. B. W. Kennedy, Prof. T. Hudson Beare, Sir William Matthews, Prof. J. A. Ewing, Mr. R. Kaye Gray, Mr. J. C. Inglis, Mr. W. H. Maw, Sir A. Rücker and Prof. R. H. Smith. Applications for tickets should be made at once to Mr. J. A. Smith, University College, Gower Street, W.C.

Crystal Palace School of Engineering.—On Friday last Sir Alexander Kennedy, F.R.S., presented the certificates at this school. From the *Times* we gather that, in the course of some remarks delivered to the students, Sir Alexander said that there was a great temptation to young men starting on an engineering career to make up their mind that there was one particular department of engineering in which they were definitely interested, and to neglect any other part. If there was one thing that was fatal to the probability of success of an engineer in practical work, it was the idea that he should specialise when he was very young. Nearly all the men who were best known in the engineering profession were not working at the particular branch at which they started, and he advised the students of the school not to narrow their ideas to one particular branch. The British engineer owed his success to the fact that he did everything that came to his hand, whether it was his particular branch or not, and there was no doubt that the best thing was for each student to endeavour to become a thorough all-round man.

Borough Polytechnic Institute.—On Saturday last an exhibition of students' work took place at this Institute, accompanied by musical and gymnastic entertainments. Dr. J. Henderson is the head of the Electro-technics Department.

Appointments Vacant.—Principal for the Battersea Polytechnic (£800); junior assistant engineer in the Birmingham Corporation Electricity Supply Business Development Department (£100 to £150); assistant lecturer in physics and electrical engineering for the Battersea Polytechnic (£180); switchboard attendant for Eccles Corporation (24s.); assistant for Ipswich Corporation Installation Department (£2).

A long pull and a strong pull.—They were watching a band of sturdy navvies hauling on a 3-in. hawser drawing in a large section lead-covered cable through conduit, and the budding works manager had just finished an elaborate detail description of the use of the ferret in mains laying, when his best girl turned to him and artlessly remarked as the gang gave a particularly laboured heave: "Then what are they doing now, pulling the ferret back?"

International Exhibitions Committee.—At a meeting of this Committee held last week, evidence was given by Mr. Arthur Greenwood, chairman and managing director of Messrs. Greenwood & Batley, Ltd., Leeds.

Electric Shock Fatality.—According to the *Montreal Witness*, early in April, Charley Canoe, 38 years of age, a Caughnawaga Indian, was killed by an electric shock at the Dominion Car and Foundry Co.'s works at Blue Bonnets. Canoe stood 6 ft. 3 in., and in the rush for the pay office his head struck an electric switch which was set low down; the shock killed him instantly. He had suffered from heart disease for some time.

Prices of Material delay American Electrical Trade.—According to the *Morning Post* the Western Electric Co., of Chicago, has reduced its force of 25,000 men by 5,000, "owing to the prosperity of the country." It is said that the high price of copper, steel and other metals has so enormously increased the cost of electrical construction, that customers are waiting to place orders until a slackening in the business brings about a fall in prices.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Ealing T.C. has appointed Mr. J. A. Brown rental and collecting clerk in the electricity department.

Mr. W. J. Maybery, resident engineer of the Pontypool Electric Light and Power Co., Ltd., has sent in his resignation to the directors.

The West Ham T.C. has made the following appointments:—Mr. Blake, late of the County of London Electric Supply Co., as mains assistant, at a salary of £150 per annum; Mr. Mackenzie, of the Glasgow Corporation, as boiler-house foreman superintendent; and Mr. J. H. Eades, of the Charing Cross Supply Co., as mains draughtsman.

Mr. H. Owen, of the Uxbridge electricity works, has secured the appointment of charge engineer in Cheltenham Corporation electricity department, which was recently advertised.

At Birkenhead, in the electricity department, the following increases have been made:—Mr. J. P. Shallcross (assistant electrical engineer), £250 to £275; Mr. E. Taylor (tramways), £230 to £255.

Tramway Officials.—A special committee of the Liverpool Corporation has gone into the matter of the officials' salaries, with the result that Mr. John A. Brodie, city engineer, has had his salary increased from £1,500 to £1,600; and Mr. C. W. Mallins, tramway manager, from £700 to £750 per annum.

General.—The Hon. J. W. Taverner, Agent General for Victoria, informed a Press representative on Tuesday that Mr. Bent, Premier of Victoria, would arrive in London at the end of this week, or the beginning of next. One of the principal objects of his visit was to make inquiries with regard to the proposed electrification of the Melbourne and suburban railways. Amongst the lines which are likely to be dealt with are the following:—Melbourne to Brighton, nine miles; St. Kilda, three miles; Port Melbourne, two miles; Bexbill, eight miles; Caulfield, seven miles; Heidlebergh, eight miles; Collinwood, two miles; and others, which would bring the total to about 50 miles. Mr. Bent is to have the advice of Mr. Thomas Tait, the chairman of the Victorian Railway Commissioners, who travelled with the Premier as far as Naples, and there broke his journey. He will arrive in London, it is expected, in two or three weeks. Mr. Tait was originally connected with the Canadian Pacific Railway, and went to Australia on a five years' engagement, which has recently been renewed. Mr. Bent is an ardent Imperialist. While in London he will stay at the Hotel Victoria.

Mr. John Gavey, C.B., late Engineer-in-Chief to the Post Office, has accepted a seat on the board of the United River Plate Telephone Co., Ltd.

Mr. J. Elders, of West Hartlepool, has been appointed electrical engineer for Messrs. J. Butler & Co., of Stanningley, Leeds.

Dr. Alexander Graham Bell, of telephone fame, is a passenger on the White Star steamer *Cedric*, due at Liverpool from New York on Saturday, the 27th inst.

Mr. Percy Rosling, M.I.E.E., for a number of years manager of the Leeds office of the British Thomson-Houston Co., Ltd., Rugby, and recently on the staff at the head office, Rugby, is leaving shortly for Australia, to accept a responsible position there. On the departure of Mr. Rosling from Rugby he was presented, on behalf of many of his friends on the staff of the B.T.-H. Co., with a beautiful silver rose bowl of an unconventional pattern and style.

Obituary.—The death is announced of Mr. George E. Davis, founder and editor of the *Chemical Trade Journal*, in his 57th year.

CITY NOTES.

Hong Kong and Singapore Tramways.

At a meeting of the Mines and General Trust, Ltd., and Reduced, held at Cannon Street Hotel, on 5th inst., at which reconstruction proposals were adopted, the chairman, Mr. Edmund Davis gave some particulars of the above tramways undertakings in which the Trust is interested. He said that they were large shareholders in the Electric Traction Co. of Hong Kong, Ltd., and the Singapore Electric Tramways Co., Ltd. In the former undertaking very substantial improvements had been made in the traffic receipts, which for the year ended December 31st last amounted to $367,613, as against $270,030 for 1905, and for the first thirteen weeks of the current year to March 30th, $102,213, being an increase on the corresponding period of 1906 of $18,452. The increase in 1906 was largely brought about by the addition of ten new cars to the rolling stock, which commenced running in September, 1905. It was also evident that the trams were coming gradually more and more into favour with the Chinese, and it was anticipated that Messrs. Butterfield and Swire's new dock, which had been in course of construction for some considerable time, would be opened during the summer, when further increases in the receipts might be confidently expected. As regards working expenses, these had been considerably reduced, and should now be about 55 per cent. In the Singapore Electric Tramways, Ltd., the steady increase in traffic receipts was very well maintained, and there were no signs that anything like a maximum revenue from traffic or lighting had been reached. The total receipts for the quarter ended September 30th, 1906, were $107,812; for the quarter to December 31th, 1906, $112,113; and for the quarter to March 31st, 1907 (estimated), $130,000. The working expenses for the last four months of 1906 were 57·8 per cent., and it was estimated that for the current year they would prove to be considerably lower; but taking the expenses at the figure named, and assuming no better returns than those shown for the first quarter of the current year, the receipts per annum would show $520,000, against an expenditure of $300,500. At present the system was not completed, and they might fairly assume that when it was, additional revenue would accrue, and to this should be added increased revenue from the sale of energy to the municipality. The revenue from this source was small at present, but October showed an increase of nearly 25 per cent. on August, 1906, and December, 1906, showed an increase of 30 per cent. on October, 1906.

William Griffiths & Co., Ltd.—The report for the year ended October 31st states that, whilst the result of the year's trading is considerably more satisfactory than that of the previous year, the directors regret that the continued general depression in trade, augmented by the economy which is being exercised by municipal authorities, has considerably curtailed the turnover of the business. In consequence of this, competition has been keener than ever, with the result that it has been impossible to obtain such profit as would be adequate to cancel the losses previously sustained. The result of the year's trading shows a net profit of £1,923, compared with a loss in the previous year of £16,083. The second case against the Middlesex County Council has been referred to the Courts, as the directors were dissatisfied with the legal view taken by the arbitrator in the first case, and it is hoped that a different result may be obtained, so that at least a portion of the amount which has been written off will be recovered. At the last general meeting the directors stated that, in view of the scarcity of work in this country, they were turning their attention to work abroad, and had negotiations pending regarding extensive contracts; these negotiations did not, however, result in any contracts being undertaken, as the terms offered were not considered commensurate with the risks to be run.

Canadian General Electric Co., Ltd.—The report for 1906 states that the business for the year has been most satisfactory, and has resulted in a profit of $853,675. To this must be added the amounts of $220,000 received as premium on the issue of stock, and $90,762, the balance brought forward, making a total of $1,164,437. $184,690 has been paid out in dividends, $71,160 for bank interest, $320,000 has been added to reserve fund, $219,553 has been written off for depreciation, and the balance of $69,034 remains at credit of profit and loss account. Owing to the rapid development of the company's business in all departments, the directors last year approved of the construction of two new large manufacturing buildings—one at Peterboro' and the other at Davenport. Both of these buildings are of steel-frame construction and designed for heavy working strains. They are nearly completed, and, when equipped with modern electric travelling cranes and other up-to-date appliances, will enable the company to accept a larger proportion of the business offering, without a corresponding percentage of increase in operating expenses. The cost of these buildings, when completed, will amount approximately to $350,000, exclusive of machine tools. The machinery and tool equipment at the Davenport works has been materially added to, and it is expected that by about July 1st next, the company will commence to reap the benefit. The new foundry for manufacturing cast-iron gas and water pipes is now completed, and will be in full operation by about April 1st next. This foundry will have an output of four times the tonnage of the old pipe foundry. The amount of unfinished work on order at the end of the year (apparatus, machinery and supplies in various stages of manufacture) amounted, at the contract prices, to upwards of 4 millions of dollars, and as new contracts have been closed during the first two months of 1907 which exceed in amount those of the corresponding period of last year, the successful operation of the factories during the current year is assured.

Cuba Submarine Telegraph Co., Ltd.

The seventy-first ordinary general meeting of this company was held on Wednesday, April 17th, at the offices, 58, Old Broad Street, Mr. C. W. Parish in the chair.

The Chairman, in proposing the adoption of the report (see Electrical Review, April 12th, page 613), said he was pleased to say that he had a satisfactory account to lay before the shareholders, their traffic receipts during the past six months having been larger than for some time past. The half-year ending June, 1905, gave them £14,811 from traffic; the following half-year it was £13,151; the first half-year of 1906 it was £17,638, while, for the six months ending December last it was £18,458. That marked increase in traffic was principally due to the political rising which took place in the island, followed by the intervention of the United States Government. That threw a great deal of work upon their cables, and they kept their stations open at night time so as to be of the best possible service to the authorities. Beyond those exceptional causes of increase, a considerable movement had been going on in all business in Cuba. Their cables had worked very well, and luckily their property did not seriously suffer from the terrible cyclone which occurred last October. Beyond the £18,458 from traffic, they had received £1,549 from interest for the half-year, making together £20,007. Their expenses amounted to £6,513, leaving a balance of £13,494. They were therefore able to provide £3,000 for the preference dividend, £4,000 for a dividend at the rate of 5 per cent. per annum on the ordinary shares, and to place £6,000 to the reserve fund. He thought they would agree with the directors in thinking that that was a good showing for the half-year, and one which he congratulated the shareholders upon. The expenses had only increased by £256, which was due to local expenses at the various stations. The board were exceedingly glad to be able to increase the reserve fund to £98,000. That was the true corner stone of every cable company—to have a strong reserve, and they felt it was the only way by which the interests of the shareholders could be securely protected. They had failed in obtaining in the law courts at Cuba, the due recognition of their claim for the subsidy granted them by the Madrid Government, when they laid the coast cables.

They thought they had been very hardly treated in the matter, but he supposed authorities there took a different view of it. They were now going to make a claim in Madrid, and he hoped they would be more successful than they had been in Havana. It was one of those difficult questions which arose from time to time. They were in communication with the British Foreign Office, and he was sure they would do what they could to help them at Madrid. Their claim against the United States Government for the damage done to their cables at the time of the Spanish-American war was, he regretted to say, still unsettled. To get payment even for the most just claims out of Governments seemed a terribly slow process, and all he could say was that they meant to go on hammering away, and they hoped in time to receive what was due to them. They understood that a cable was shortly to be laid from New York to Colon, in the Isthmus of Panama, and they believed those cables would touch at a point on the coast of Cuba. The communication between Cuba and the United States was also to be increased by the laying of a cable from New York to Havana. At present they could not tell to what extent those new cables would affect their business, but they were carefully watching the position, and their policy of strengthening the reserve fund was one which they thought would tend to the best interests of the company. They had been left pretty well alone for many years. That was the seventy-first half-yearly meeting, but as time went on, they must expect that others would wish to lay cables to Cuba or to Colon, and it was natural that they should touch at Cuba. He was afraid they could not do anything in the matter, but it was a sign of competition, and it was no use shutting their eyes to it. As far as the present half-year had gone, the traffics had been very good. The earthquake in Jamaica brought them in an unexpected amount of Press and private business, and he hoped that when they met the shareholders next half-year they would be able to present another satisfactory report.

Mr. George Keith seconded the motion.

Replying to a Shareholder, the Chairman said that their exclusive concession expired in 1910, and that consideration influenced the board in regard to the amount they paid as dividend on the ordinary shares.

The report was adopted.

Harrow Electric Light and Power Co., Ltd.

The directors' report for 1906 says that as stated in the last report, they made a substantial reduction in the charges for lighting. The result has justified that course, the consumption having increased by 40,000 units, an increase considerably in excess of that of any previous year. The lamp connections also show a satisfactory increase of 4,013 lamps of 8 c.p. The additional output of electrical energy has led to further economies in the working expenses, with the result that the net revenue, notwithstanding the reduction of the charges, is but slightly lower than that of the previous year. The receipts from all sources amounted to £7,938, against £7,789 in 1905. The expenditure amounted to £3,285, against £2,947 in 1905. The works costs amount to 1·36d. per unit, as against 1·42d. in 1905, and 1·67d. in 1904, and the total working expenses, exclusive of depreciation and capital charges, work out at 2·42d. per unit, against 2·48d. in 1905, and 2·61d. in 1904. The surplus of the revenue account, after providing £1,800 for depreciation, amounts to £2,853, and after adding the profit on wiring account, and the balance brought forward from 1905, the sum available for distribution is £3,458. Of this sum debenture and other interest, and the interim dividend on preference shares, has absorbed £1,075, leaving a balance at credit of net revenue account of £2,384. The directors recommend a final dividend on the preference shares absorbing £375, a dividend on the ordinary shares at 5 per cent. per annum, requiring £1,427, leaving £582 to carry forward. The depreciation fund is now £13,470. The reserve for doubtful debts has been brought up to £200. £4,645 was expended on capital account during the year, the bulk of which represents the cost of an extra feeder main to Greenhill, where the extension of the company's business has chiefly taken place. The directors issued during the year the balance of the authorised amount of ordinary shares, amounting to £6,325, the whole of which was taken up by the shareholders. Owing to an appointment in another company, Mr. Walter Barnes resigned his post as secretary, and they have appointed Mr. William H. Bishop to take his place. Mr. Percy Olver has resigned the post of resident engineer, and the directors have appointed as engineer and manager, Mr. J. A. Bernard Horsley, A.M.I.E.E.

Babcock & Wilcox, Ltd.

The report of the directors for 1906 states that the net profit during the year, after deducting depreciation, &c., amounts to £285,928. To this has to be added the balance brought forward from last account, plus £31,967 brought forward, making £317,895. Interim dividends were paid last October of 3 per cent. on the preference shares, and of 8 per cent. on the ordinary shares, amounting to £69,400, leaving £248,495. The directors now recommend that for the last half-year, ending December, a dividend of 3 per cent. on the preference shares, requiring £3,000, and of 8 per cent. on the ordinary shares (free of income-tax), £66,400, with a bonus of 4 per cent. on the ordinary shares (free of income-tax), £33,200, be paid, placing to reserve fund £100,000, and to dividend equalisation fund £20,000, leaving £25,895 to be carried forward. Further extensions at the works have been undertaken, for which it is expected ample employment will be found. The volume of the company's business during this year so far is increasing.

The annual meeting was held yesterday.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

At Winchester House on Monday last, Mr. R. W. Wallace, K.C., presided over meetings of the preferred and deferred shareholders, held by the direction of the Court, at which resolutions were unanimously passed approving of the scheme of arrangement which had formed the subject of consideration at several previous meetings.

The Chairman said that the meeting was the last of a long series that had had to be held, owing to the complicated machinery for carrying out the proceedings in a legal manner. The sanction of the Court to the scheme would now be applied for at once, and then they would be in a position to distribute the respective securities among the shareholders of the company. The affairs of the company were going on extremely satisfactorily. Last month they made more profit than they had made this year, and during the three months of this year the profits made had been greater than in any former three months of the company. As soon as the matter was through they would be able to pay the dividends. In reply to a question regarding the necessity for a reconstitution of the board, the chairman said that there was a vacancy that would be filled up. He would ask one of the largest shareholders to go on to the board, and if anyone had any suggestions to make and they would write to him, he would consider them. A shareholder suggested that the board should leave the appointment to the shareholders, otherwise they would vote against it.

Perth (W.A.) Electric Tramways, Ltd.

The directors' report for 1906 says that the gross receipts amounted to £78,543, as compared with £74,485 for the previous year, while the net profit amounted to £35,261, against £32,042 for 1905. After payment of interest and sinking fund on the first and second debenture issues and trustees' fees for the year, the balance at credit of profit and loss account is £17,740, which is carried to profit allocation account. To this is added the balance brought forward from last year, viz., £2,675, making £20,415, from which has to be deducted £6,000, dividend paid on preference shares for the year, leaving a balance of £14,415. £6,125 has been expended on the North Perth extension and new car Barn, and added to reserve account. There has been put to cash reserve fund £2,500; a dividend is paid on ordinary shares at 5 per cent., £5,000, carrying forward £790.

The directors regret the necessity for the continual capital expenditure out of revenue, but the construction of the extension and the erection of the additional car barn were absolutely necessary both for the convenience of the travelling public and for the protection of the cars. The directors are alive to the fact that the amount of capital expended out of revenue now amounts to upwards of £22,000, whereas the dividends paid and now recommended on the ordinary shares amount to £7,500, being less than 1 per cent. per annum since the incorporation of the company. After the completion of the North Perth extension and the possible purchase of additional cars, the directors hope that the annual capital expenditure will be materially reduced. The sum of £4,081 shown in the balance-sheet as cash in the hands of the trustees has since been partially utilised in the redemption of £3,395 of first mortgage debenture stock. An application was made for an official quotation for the preference and ordinary shares. A quotation has been granted for the ordinary shares, but it cannot be obtained for the preference shares until they are held by a larger body of shareholders. The directors desire to record their appreciation of the services of Mr. Somerset, Mr. E. Graham Price, and the staff in Western Australia during the past year.

The report of the engineer and manager (Mr. H. J. Somerset) says that during the year 1,167,763 car miles were run, as against 1,115,189 car miles in 1905; and 8,083,315 passengers carried, as against 7,590,057 in 1905. The earnings per car mile in 1906 were 15·97d., as against 15·22d. in 1905, with an expense of 8·3d. per car mile in 1906, as against 8·34d in 1905. The expenses per cent. of earnings in 1906 were 51·94 per cent., as against 54·82 per cent. in 1905. The total receipts, including car advertising, in 1906 were £77,727, as against £73,256 in 1905; and the total Perth expenses in 1906 were £40,368, as against £40,159 in 1905; leaving a net increase for the year 1906 over 1905 of £4,262. The company is again in need of rolling stock, and it will be necessary to obtain during the present year five more cars of the single-truck type. The mileage authorised is 27 miles 50 chains, and constructed 2 miles 60 chains.

Prospectus.—*The Aluminium Corporation, Ltd.*—This company has been offering 300,000 7 per cent. participating preference shares of £1 each for subscription at par. The list of applications was to close yesterday. The company acquires freehold lands and water rights in North Wales for the purpose of establishing works to manufacture aluminium. The directors are Sir J. Sivewright, Wm. Beardmore, of Glasgow, E. Manville, and W. A. Smith, of Glasgow. Contracts have been made with the North Wales Power and Traction Co., Ltd., to take electrical power from the Snowdon Power Station up to 800 H.P. for five years, and subsidiary works are to be erected near the transmission lines of that company. The engineers state that 6,000 H.P. will be available on the completion of the works proposed by this issue. A joint tender has been received from Messrs. Bruce Peebles and Co., Ltd., and Messrs. Bott & Stennett, Ltd., at £175,854 for the hydraulic, electrical and other works. Messrs. Harper Bros. and Co. and Messrs. Kincaid, Waller, Manville & Dawson are appointed engineers at 6 per cent. upon the price to be paid for the construction and equipment of the hydraulic and electrical work.

Craigpark Electric Cable Co., Ltd.—The directors recommend a dividend of 6 per cent. per annum on the preference shares for the half-year, and 6 per cent. per annum on the ordinary shares for the 12 months ended March 31st last.

Dudley, Stourbridge and District Electric Traction Co., Ltd.

The report for 1906 (which was presented at the meeting held yesterday) shows gross receipts amounting to £46,282, and the expenditure to £32,139, including £500 placed to depreciation and renewals account, interest on debentures, costs of repairs and maintenance, and all other expenses properly chargeable against revenue, leaving a balance of £14,143. After deducting the dividend on the preference shares accrued to December, 1906, and adding the balance of £507 brought forward, there remains an amount available for allocation of £9,650. The directors recommend that there be placed to the reserve (sinking) fund to provide for the depreciation of assets, redemption of debentures, and for general purposes, £2,600; to special Kinver Light Railway depreciation fund, £1,000; to the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, £5,000; to be carried forward to next account, £1,050. The expenditure on capital account during the year amounted to £2,699, and included payments on account of doubling a portion of the Kinver line, putting a new siding at Kinver, &c. The continuation of the arrangement entered into with other companies operating in the district for joint workings under one management had been justified by the results, economies having been effected in all departments during the past year. The working expenses had been reduced by over £2,000, while the receipts had been maintained to within £380 of the previous year. The registered offices had been moved from Birmingham to Donington House, London.

The number of passengers carried was 8,432,344, against 8,370,791 in 1905; the average receipts per passenger were 1·18d., against 1·32d.; average working expenditure per passenger ·78d., against ·84d.; proportion of expenses to receipts 60 per cent., against 63 per cent.

City of Birmingham Tramways Co.

The directors' report for 1906 (which was presented at the meeting held yesterday) says that the revenue account, after providing £12,000 for the year's interest on debentures and £12,083 the dividend on preference shares paid and accrued up to December 31st last, shows a surplus of £79,131, from which is deducted the sum of £2,105, being the interim dividend at the rate of 5 per cent. per annum paid on the ordinary shares for the half-year ended June 30th, 1906, leaving a disposable balance of £77,026. The directors recommend the payment of a dividend on the ordinary shares at the rate of 5 per cent. per annum for the six months ended December 31st last, together with a bonus of 5 per cent., making 10 per cent. for the year, amounting to £6,314 2s.; transferring £70,712 to reserve fund, thereby increasing that fund to £431,768 to provide for depreciation of assets, redemption of debentures, and for general purposes. The expenditure on capital account during the year, less credits, amounted to £3,635, and included payments on account of reconstructing the Stratford Road tramways in Yardley for electric traction. The seventh annual instalment of £10,000 payable under the debenture trust deed has been duly paid to the trustees. The debenture redemption fund has further been increased during the year by the payment to the trustees of £20,000, the amount received from the Birmingham Corporation as the purchase price of the tramways in Balsall Heath; by £16,000; the purchase price of the Kyotts Lake Road depôt; by £26,000 received from the King's Norton Council for the portion of the King's Heath and Moseley tramways within that district, and for the King's Heath depôt; by £11,705, the amount fixed by the arbitrator as the value of the company's steam tramway undertaking in Handsworth; and by £1,050, the proceeds of the sale of the Moseley and Small Heath depôts. These amounts, together with interest and accumulations to December 31st, 1906, make the fund in the trustees' hands £187,134. Negotiations have taken place with the Rural District Council of Yardley with a view to the sale to them of the company's undertaking and interests in Yardley, but it has not been found possible to come to any agreement. The tramway on the Stratford Road, between the city boundary and College Road, Yardley, has been reconstructed for working by electric traction and an arrangement has been made by which the Corporation of Birmingham operates the section of this tramway belonging to the company. The energy for working this section of the line is supplied by the company from its power station in Yardley. The Coventry Road tramway, which is partly within the city and partly in Yardley, is worked jointly by the Corporation and the company on the basis of the receipts in each area belonging to the owner of the line. All the lines in Aston which are worked by the company have now been reconstructed, and are working by electric traction, with the exception of the Wheeler Street route, which it is not proposed should be reconstructed until some arrangement has been made with the Birmingham Corporation for the reconstruction of the continuing section in Great Hampton Row. Negotiations are also proceeding with the Birmingham Corporation with a view to an arrangement being made for the operation of through services between Birmingham and Erdington, and Birmingham and Perry Barr, Handsworth; and some delay has been caused in negotiating these arrangements, by an application that has been made to the Board of Trade by the Aston Corporation to appoint an arbitrator. Several of the outstanding matters between the Aston Corporation and the company have been settled, and it has been possible during the year to work the system to greater advantage. A short section of line in Villa Road, being the continuation in Handsworth of the Lozells tramway in Aston, has not yet been purchased by the Council, which has applied to the Board of Trade for an order declaring the tramway derelict, which would have the effect of the Council taking possession of the tramway without paying the company the value thereof. The directors are strongly opposing such an order being issued. The policy of the directors in all these negotiations has been, while not submitting to any wrongful demands by the local authorities, to assist them to provide, in conjunction with the companies, the best possible travelling facilities for the public.

The surrender on December 31st last to the Corporation of Birmingham of 10¼ miles of tramway in Birmingham and the sale of the tramways in King's Norton has produced the following financial position:—

The assets, either in cash or easily realisable, consist of: Sums deposited with the trustees and invested by them, £187,134; amount temporarily invested by the company, £211,650; total, £398,784. In addition to the revenues till 1911 from the tramways under lease to the company and the overhead equipment of the Bristol Road and Coventry Road tramways inside the city, the company possesses nearly five miles of cable and electrically-equipped tramways outside the city, and generating stations, car sheds, and rolling stock required in connection therewith. There are also 50,996 fully-paid preference and ordinary shares of £1 each in the Birmingham and Midland Motor Omnibus Co. The cash already realised is more than sufficient to pay off the whole of the £300,000 debentures, but cannot be applied to this purpose, as the debentures are not redeemable until October 15th, 1917, unless the company be wound up or fail to perform the covenants of the trust deed. If the debentures are not paid off until 1917 there will be a continuing loss arising out of difference of interest and expenses of about £3,000 per annum, and the directors are, therefore, carefully considering the question of winding up the company, and a further communication will be made to the shareholders on the subject. The management of the company's undertaking by the Birmingham and Midland Tramways Joint Committee has shown satisfactory results, economies having been effected in the working expenses.

The past year has been a trying one for the Birmingham and Midland Motor Omnibus Co., owing to the opening by the Corporation of Birmingham of competing tramways with very low fares, and to the heavy cost of repairs to motor omnibuses necessary to keep them in a condition to meet the company's obligations to the licensing authority. It has been necessary to purchase nine additional motor-omnibuses of an improved type in order to maintain a fair service on the Hagley Road route, as some of the older vehicles were found to be quite unreliable, and were rendering the service unpopular. Since the beginning of the present year the company has withdrawn the horse services from several routes along which the Corporation is operating tramways, and the horses and vehicles have been disposed of. This policy the company propose to follow in the case of other routes if it is found that they cannot be worked except at a loss. The registered offices of the company have been removed from Birmingham to Donington House, London.

The number of passengers carried was 53,778,795, against 54,939,631 in 1905; the average receipt per passenger was 1·24d., against 1·24d.; average working expenditure per passenger ·73d., against ·77d.; proportion of working expenses to receipts 59 per cent., against 63 per cent.

Wolverhampton District Tramways, Ltd.

The report (which was presented at the meeting held yesterday) states that the total revenue for the year 1906 amounts to £24,280. After deducting all expenses chargeable thereto, including debenture interest, repairs and maintenance, and depreciation, there remains a profit of £3,998. With £242 brought forward there is an available balance of £4,240. The directors recommend to be placed to reserve fund to provide for depreciation of assets, redemption of debentures, and general purposes, £500; and the payment of a dividend at the rate of 2 per cent. per annum on the ordinary shares (£3,196); carrying forward, £544. The capital outlay of the year was £1,056, which included the cost of equipping ten cars with Loram skates to enable the company's cars to operate into Wolverhampton in accordance with the arrangement made for running powers with the Wolverhampton Corporation. The continuation of the arrangement entered into with other companies operating in the district for joint working under one management has been justified by the results. The directors are pleased to report that the receipts show an increase of £1,967, and the expenses an increase of only £102. The arbitration proceedings with reference to the tramways in Dudley have not yet been concluded, the question of the price to be paid for Light Railway No. 5 of the order of 1898 having been taken to the House of Lords from the Court of Appeal by the Dudley Corporation.

Intercommunication has now been established between Wolverhampton and Dudley, and through services commenced in October last. The arrangements also provide for the Wolverhampton cars to operate to Willenhall, and have proved very satisfactory to both the company and the local authorities concerned. Arrangements have been made in conjunction with the South Staffordshire Tramways (Lessee) Co. for the provision of a through service of cars between Bilston and Walsall after May 1st next. The registered offices of the company have been moved from Birmingham to Donington House, London.

The number of passengers carried was 4,102,374, against 3,640,275 in 1905; average receipts per passenger were 1·39d., against 1·44d.; average working expenditure per passenger, ·89d., against ·99d.; proportion of expenses to receipts, 64 per cent., against 69 per cent.

Oriental Telephone and Electric Co., Ltd.

The directors' report for 1906 states that, including £1,738 brought forward, and after deducting the interim dividends of 3 per cent. already paid on the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and share capital, and other charges as shown in the net revenue account, there remains £13,133 to be dealt with. It is proposed to pay a final dividend for the year of 3 per cent. on the preference shares issued, less income-tax, £1,425; a final dividend of 4 per cent. on the ordinary shares issued, free of income-tax, making 7 per cent. for the year, £7,173, and to transfer to reserve account, £3,500, carrying forward £1,036. The company's underground cabling operations in the cities of Madras, Moulmein, Rangoon and Singapore are steadily proceeding, and it is fully expected that before the close of the current year these important and necessary schemes, as originally laid out, will have been completed. During the progress of these cabling works it has, of course, not been possible to fully meet the demand for new exchange connections, the effect of which has made itself felt in the revenues for the past year, but the directors confidently look for increased business when the new systems are finally completed.

The Indian local companies have declared the same dividends as for 1905, viz., the Bengal Telephone Co., Ltd., 5 per cent., and the Bombay Telephone Co., Ltd., 6 per cent., and the amounts have been included in the revenue account. These companies have also been busily engaged during the year with cabling their systems, and with the installation of new switchboards. This company has agreed to provide the necessary financial assistance in the case of the Bengal Co., which is secured by a mortgage debenture bond. The Bombay Co. has raised funds locally.

The Telephone Co., of Egypt, Ltd., has declared its usual dividends, viz., 7½ per cent. for the year on both its preferred and deferred shares, which have also been brought into account. That company has acquired its own freehold exchange premises at Alexandria and Cairo, and is also engaged with extensions to its cable systems and further installations of provincial lines for the Government of H.H. the Khedive. In order to assist the Egyptian Company with funds for the above, your directors, on behalf of this company, have taken up a further 4,000 preferred shares of £5 each. These shares will earn full dividend in the current year.

The China and Japan Telephone and Electric Co.'s exchanges at Hong Kong and Kowloon continue to make progress.

The electrical branch of the company has been worked to a moderate profit, but competition in the East, as elsewhere, has been very keen. After the ordinary general meeting an extraordinary general meeting will be held to consider alterations in the articles of association.

The thirteenth ordinary general meeting of this company was held on Wednesday at the Great Eastern Hotel, Liverpool Street, Sir Austin Colvin, K.C.S.I., in the chair.

In proposing the adoption of the report, the Chairman said the position of the company was very satisfactory. The main feature of the year had been the progress made in their extensive cabling operations, by which they expected ultimately to improve their position very materially. He was glad to say that those operations were now drawing to a close. They would have noticed that they were carrying a smaller amount to reserve than last year, but on the other hand the full year's charge for interest on the debenture stock issued had to be met, viz., £4,000, as against £1,230 in 1905. The amount required for the redemption fund of the debenture stock had likewise to be provided for for the first time, viz., £887, and also an increased amount for the sinking fund on the ordinary share capital—a total increase of £4,640, the total result being that the position was practically the same as in the preceding year. It must also be borne in mind that owing to the cabling operations, they had had to delay connecting many new subscribers, which had necessarily affected the revenue for the time being. It so happened that by force of circumstances they had been compelled to send out in the course of the past year no less than four assistant managers. Since the beginning of the present year an improvement had already taken place, and there was every reason to anticipate that the steady increase in the number of subscribers would now be resumed, as had been the case hitherto until their reconstruction operations caused a temporary interruption. In regard to Egypt, he had lately visited that country, and he was satisfied as to the very valuable assets they possessed in their holding of the shares of the Telephone Co. of Egypt. It was arranged during his visit that the large province of Fayoum should be added to their field of operations. An inquiry had reached the secretary on the subject of the valuation of the securities held by the company. The only shares they held, which were dealt in publicly, were the Bombay Telephone shares, which were now quoted in Bombay—their nominal value being 25 rupees—at 40 rupees, and the Bengal Telephone shares, their nominal value being 100, which were now quoted in Calcutta at 80 rupees. The shares of the Telephone Co. of Egypt were practically all owned by the company, and as they paid a 7½ per cent. dividend per annum they might fairly be taken at par value. The same might be said of their China and Japan debentures. The total value of the securities they held was, in the opinion of the directors, considerably in excess of the amount at which they were credited in the balance-sheet, while the lives of most of their concessions were in no instance under 25 years, and in some cases they were 30, 35 and 60 years. The same remark applied to their freehold properties, which were worth much more than what they stood at in the books. The only exception was Consols, which cost them about 96, and on which there was a loss. When they recovered their price somewhat it was the intention to sell them, and utilise the money in the business.

Mr. Henry Grewing seconded the motion, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Edmundson's Electricity Corporation, Ltd.—Further issue of £83,000 4½ per cent. first mortgage debenture stock.

Hove Electric Lighting Co., Ltd.—Further issue of 2,000 ordinary shares of £5 each, fully paid, Nos. 13,001 to 15,000.

Calcutta Electric Supply Corporation, Ltd.—The directors have decided to recommend, at the meeting on May 9th, that £12,000 be transferred from the profit and loss account to the depreciation fund, bringing this amount up to £45,000; that a dividend, at the rate of 10½ per cent., for the half-year ended December 31st last, be paid, making, with the interim dividend, 8½ per cent. for the year, and that £5,286 be carried forward. The transfer books are closed from April 25th to May 9th inclusive. The number of units delivered to consumers during the five weeks ended March 29th, 1907, were 432,221, compared with 370,234 units in the corresponding five weeks of 1906.

Buenos Ayres and Belgrano Tramways Co., Ltd.—The report for the year 1906 says that the revenue account, including £5,375 brought forward, shows an available balance of £76,162. Of this there has been applied in payment of debenture stock charges, £28,068; to renewals fund, £8,500; preference dividends, £20,250. The directors recommend a dividend of 3s. per share on the ordinary shares (3 per cent. per annum) carrying forward £4,033. An agreement has been entered into with the Compagnie Generale de Tramways de Buenos Ayres for the sale of the company's undertaking, subject to the approval of the debenture stock and shareholders, for £1,350,000, of which £200,000 is payable forthwith in cash and the remainder at the option of the purchasers upon 12 months' notice within 50 years. Interest on the balance of the purchase money—until completion—amounting to £60,500 per annum, would be sufficient, after meeting all prior charges, to admit of a dividend of 4 per cent. per annum on the ordinary share capital. When the balance of the purchase money is paid the ordinary shareholders will, it is estimated, receive a return of not less than £4 5s. per share on liquidation after redemption of the debenture and repayment of the preference shares at par. If the agreement is approved, it is proposed to apply the £200,000 in redemption *pari passu* of 5 per cent. (first) debenture stock at £115 per £100 of such stock.

Ascot District Gas and Electricity Co.—The directors of this company have issued a circular to the shareholders, stating that they have obtained tenders for the necessary plant to enable the company to supply electricity in the neighbourhood of Sunningdale and Sunninghill, and it will now be necessary to raise additional capital for this purpose, and also to pay for certain extensions in connection with the gas plant. According to the *Financial Times*, a meeting is to be held on 1st prox. to authorise the directors to raise additional capital by the issue of £8,000 4 per cent. perpetual debenture stock and 1,000 7 per cent. ordinary shares of £10 each.

Kepitigalla Rubber Estates, Ltd.—The general manager in Ceylon reports that a crop of 42,612 lb. of rubber had been harvested at March 31st. Rubber seed sold and delivered, £4,666. The most satisfactory feature is the steady increase in the yield of rubber, the production for the last three months having been:—For January, 3,000 lb.; February, 3,567 lb.; March, 5,045 lb. The estates are maintaining their reputation for the excellence of the rubber seed, and already orders have been booked for a large quantity of seed to be delivered during the coming season. There are over 21,500 Para rubber trees, from six to 16 years old, in bearing on the estates, over 126,000 from three to four years old trees, and over 209,000 two-year-old trees, while a large additional area has been cleared and planted with rubber during the past year.

Rubber Estates of Johore, Ltd.—The report for 1906, states that Mr. A. L. Buyers, manager of the company's estates, reports 250 acres planted with rubber, 360 acres burned and 800 acres felled. Last August it appeared that 500 acres would be planted by the end of last year, but the weather conditions not having been favourable for burning, no planting took place until the present year. The wet weather was, however, particularly suitable for the germination of the seeds planted in the nurseries, and the 250,000 seeds so far put out are coming on well. Nursery space has been prepared for another half-million seed. The manager's estimates for 1907 are based on 600 acres of new clearings on Sungei Senarut, in addition to 350 acres which were already in hand in 1906. On Sungei Gomali 700 acres are estimated for, in addition to 303 acres in hand in 1906. The directors trust that the programme estimated for by the manager, which would give 1,953 acres under cultivation at the end of 1907, may be fulfilled.

Brisbane Electric Tramways Investment Co., Ltd.—The revenue account for 1906 shows, including £2,618 brought forward, an available balance of £47,282. There is applied in payment of debenture stock interest, £18,703; in payment of preference dividend (5 per cent.), £17,812—together £36,515; £1,000 is carried to accidents insurance fund (bringing the same to £2,000); a dividend of 2s. per share is paid on the ordinary shares, and £2,267 carried forward. The appropriation of the available balance of the tramways company, of which this company holds all the shares, includes an allocation to renewals fund of £10,000 and a carry forward of £1,674.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date, or 52 weeks. £	£*	Route miles open.	Inc.
Aberdeen	Apr. 17	2,460	— 206	46	63,572	+ 1,883	14·4	..
Ayr	,, 20	460	— 125	49	13,873	— 22	8	..
Bath	,, 17	1,426	— 591	16	10,787	— 146	13	..
Belfast	,, 19	6,600	— 859	3	10,050	+ 531	40	6½
Birkenhead	,, 21	1,870	— 467	3	2,990	— 370	13·5	..
Birmingham Corp.	,, 13	11,158	..	2	11,158	..	28·25	..
†Blackburn	,, 10	985	+ 50	2½	3,229	+ 1,187	13·6	..
†Blackpool Corp.	,, 18	452	—1,820	2½	2,232	— 813	11·87	..
,, —Fleetw'd.	,, 20	579	— 975	15	4,544	+ 224	8·25	..
Bolton	,, 21	4,045	— 915	3	6,289	— 847	26	1
Bournemouth	,, 17	3,118	— 942	2½	4,480	— 286	21·5	2·75
Bradford	,, 20	8,088	—2,321	3	13,753	— 448	53	..
Brighton	,, 21	1,533	— 639	3	2,691	— 420	9·5	..
Bristol	,, 19	9,482	—2,415	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 12	465	+ 11	14	3,149	— 4	3·65	..
Barnsley	,, 12	383	+ 19	,,	2,265	— 7	..	..
Barrow	,, 12	507	— 25	,,	3,146	+ 28	5·37	..
Cavehill	,, 12	362	+ 191	,,	1,013	+ 251	..	..
Devonport	,, 12	985	... 61	,,	6,260	+ 192	3·85	..
Gateshead	,, 12	2,058	+ 88	,,	23,967	+ 546	11·25	..
Gravesend	,, 12	579	+ 107	,,	3,141	+ 209	6·5	..
Greenock	,, 12	1,509	+ 49	,,	8,689	+ 116	7·25	..
Hartlepool	,, 12	590	+ 3	,,	3,595	— 164	6·72	..
Kidderminster	,, 12	304	+ 101	,,	1,378	+ 40	..	..
Leamington	,, 13	406	+ 62	,,	2,005	+ 32	3	..
Merthyr	,, 12	510	+ 96	,,	2,896	+ 282	2·9	..
‡Metropolitan	,, 12	10,107	+2,461	,,	56,812	+14,405	22	..
Middleton	,, 12	939	+ 215	,,	383	+ 343	8·5	..
Mid. Joint Com'tee	,, 12	13,531	..	,,	88,586	..	..	..
Oldham — Ashton	,, 12	1,397	+ 209	,,	8,340	+ 771	9·13	..
Peterborough	,, 12	334	+ 76	,,	1,583	+ 110	5·31	..
Potteries	,, 12	3 859	+ 206	,,	25,965	+ 367	29	..
Rothesay	,, 12	653	+ 271	,,	1,153	+ 280	2·75	..
Southport	,, 12	762	+ 160	,,	3,375	— 84	8·17	..
S. Metropolitan	,, 12	1,810	..	,,	10,002	..	..	..
Swansea	,, 12	1,875	+ 180	,,	11,449	+ 693	5·5	..
Tynemouth	,, 12	519	+ 39	,,	2,387	— 97	3·75	..
Weston-s-Mare	,, 10	287	+ 183	,,	596	+ 144	3	..
‡Worcester	,, 12	644	+ 110	,,	3,494	+ 45	5·75	..
Wrexham	,, 12	239	— 19	,,	1,365	— 23	..	..
Yorks. Wool. Dist.	,, 12	2,253	+ 497	,,	13,143	+ 1,196	17	..
Miscellaneous	,, 12	526	..	,,	2,925	..	..	..
Burnley	,, 20	2,272	— 414	..	..	..	7·5	..
Burton-on-Trent	,, 21	516	— 141	3	832	— 129	10	1·5
Bury	,, 10	1,976	..	2	1,976	..	10·5	..
Cardiff	Mar. 31	2,014	+ 206	51	100,318	+ 1,352	15·87	..
Carlisle	Apr. 20	323	— 80	16	2,368	— 232	..	..
Chatham and Dist.	,, 18	1,306	— 240	16	10,111	+ 693	12·84	3·5
Cork	,, 18	888	— 116	16	6,462	— 196	9·89	..
Croydon	,, 19	2,533	—1,040	3	3,918	— 567	12	·75
Darlington	,, 20	366	— 75	3	619	— 12	..	..
Darwen	,, 19	477	— 125	3	641	— 140	4·36	..
Dover	,, 20	384	— 181	3	660	— 109	4·75	..
Dublin	,, 19	10,079	— 857	16	74,023	+ 2,127	54·25	5·75
Dundee	,, 17	2,259	+ 55	46	52,585	+ 7,105	13	·5
East Ham	,, 20	1,656	— 532	3	2,649	— 283	8	..
Exeter	,, 13	5·1	— 113	3	894	+ 9	4·75	·5
Glasgow	,, 20	34,115	+ 594	46	781,758	+61,600	86·75	7·25
Hastings	,, 18	1,871	..	..	..	..	..	..
Huddersfield	,, 20	2,822	— 660	3	4,830	+ 136	28	..
Hull	,, 20	4,409	— 346	3	6,798	— 125	13	..
Ilford	,, 20	906	— 298	3	1,454	— 213	6·37	..
Ilkeston	,, 17	233	— 36	3	439	+ 60	3·5	..
Ipswich	,, 20	678	— 292	3	1,121	— 148	10·5	..
Isle of Thanet	,, 20	703	— 451	16	4,564	+ 65	11	..
Kilmarnock	,, 20	289	— 81	49	7,696	+ 142	4·25	..
Lan'kshire Trm. Co.	,, 18	2,308	+ 521	16	16,272	+ 3,094	15·22	3·26
Lancashire United	,, 17	2,128	— 325	16	17,756	+ 4,725	38·5	10·5
Leeds	,, 13	12,997	+2,385	2	12,997	+ 2,385	96	6·5
Leicester	,, 20	4,143	— 814	..	..	..	..	..
Leith	,, 13	1,018	+ 60	46	24,233	+ 6,286	6	..
Liverpool	,, 13	22,008	+ 428	15	155,497	+ 3,096	104	..
‡L.C.C.	,, 6	59,703	+22,388	52	1,372,597	+614,505	113·9	61·6
London United	,, 19	10,846	—5,653	16	85,689	+ 2,342	..	..
Lowestoft	,, 20	277	— 33	29	4,449	+ 567	..	..
Manchester	,, 20	26,342	—1 504	3	40,761	+ 2,198	159	13
Newcastle	,, 20	7,527	—1,122	3	12,450	+ 9	..	..
‡Newport	,, 20	596	— 124	8	1,999	+ 21	14·5	..
Northampton	,, 19	750	— 248	3	1,198	— 81	5·5	..
Oldham	,, 21	3,482	— 364	4	7,975	+ 701	33·75	..
Pontypridd	,, 13	663	+ 312	2	663	+ 312	5	1.5
Portsmouth	,, 20	3,336	—1,235	8	5,693	— 544	14·5	..
†Preston	,, 17	1,316	— 272	..	..	..	..	..
†Reading	,, 11	574	— 39	..	..	..	..	..
Rochdale	Feb. 19	958	+ 152	..	..	..	20·6	..
Rotherham	Apr. 18	1,029	— 118	2½	1,531	+ 85	10	·7
Salford	,, 15	10,031	— 770	2	10,031	— 770	38·9	..
Sheffield	,, 21	10,227	— 692	4	21,386	+ 441	35·75	..
Southampton	,, 17	1,795	— 276	2½	2,390	— 61	..	..
Southend-on-Sea	,, 17	582	— 255	3	848	— 125	..	..
†Sunderland	,, 22	1,246	— 246	3	4,010	— 324	..	..
Swindon	,, 10	400	+ 31	..	..	..	4·4	..
Tyneside	,, 17	768	— 548	16	6,382	+ 490	8·87	..
†Walthamstow	Mar. 30	699	+ 172	52	28,927	..	9	..
West Ham	Apr. 18	4,271	— 933	3	7,513	+ 175	14·7	..
Wolverhampton	,, 17	2,177	— 32	2	2,177	— 32	20	..
Yorks. W. Riding	,, 21	1,984	— 142	16	17,018	..	..	..
Baker St.-Waterloo	,, 20	4,860	+2,117	6	13,615	+ 4,544	4	3·25
Cen. London Rly.	,, 20	12,963	+ 314	16	99,591	— 9,739	6	..
City & S. Lon. Rly.	,, 21	5,824	+ 761	16	47,417	+ 584	6·25	..
Dublin-Lucan Rly.	,, 19	202	— 91	16	1,525	— 28	7	..
G.N. and City Rly.	,, 20	3,695	+ 253	16	29,518	— 18	3·5	..
G.N., P'dy. & Brmp.	,, 20	7,990	+ 400	16	60,409	..	9	..
L'pool Overh'd Rly.	,, 21	2,764	— 189	16	22,258	— 76	6·8	..
Mersey Railway	,, 20	3.519	— 22	16	29,377	+ 1,189	4·5	..
Metropolitan Rly.	,, 21	30,262	—1,418	16	240,588	—25,140	24·5	..
Met. District Rly.	,, 21	15,746	—1,382	16	125,311	— 2,440	24	..
Anglo-Argentine	,, 22	35,430	+4,702	16	261,222	+21,533	43	..
§Auckland	Mar. 29	9,846	+1,312	13	82,152	+ 860	19·24	·6
§Brisbane	,,	13,199	+1,688	..	..	..	..	..
§Brit. Columbia Rly.	Feb.	24,857	+6,860	24	196,608	+35,407	..	..
Bu'n's A'r's E.T Co.	Mar. 2	3,247	+ 290	9	14,647	+ 1,859	..	..
Bu'n's A'r's-Blgr'no	Apr. 14	8,206	+ 934	15	56,317	+ 3,865	..	..
Calcutta	,, 20	6,057	+ 498	..	..	..	..	..
§Cape Electric T.Ld.	Mar.	14,549	..	..	..	..	..	..
§Geneva	Mar.	7,091	+ 546	..	..	..	..	..
§Kalgoorlie, W.A.	Mar.	4 420	..	13	11,718	..	20·5	..
Madras	Apr. 15	1,122	+ 98	15	8,038	+ 1,362	12·75	3·5
§Lisbon	Feb.	29,016	..	..	..	..	..	..
Perth (W.A.)	Apr. 19	2,911	— 139	16	24,058	— 215	25·6	·4

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS in the Stock Exchange are "patchy": some firm and with a quite respectable amount of business attaching to them; others idle, with the usual accompaniment of sagging prices. On the whole, the investment sections are doing better than the speculative departments, although the former have overhanging them the knowledge that several heavy new issues are near at hand. They are assisted, however, by the further knowledge that the Bank Rate will soon be reduced to the round 4 per cent.

Home Railway stocks have leaned to the dullish side. To excuse this, these is vague talk of deceased accounts having come to market in considerable bulk of late. The explanation is a trifle lame, and the increasing competition of new gilt-edged securities with Home Railway stocks goes far to justify the decline. Electrical varieties are quiet. Central Londons have kept their higher ground, and the Deferred rose another point to 58½. City and South London continue firm at 42; the fact that the directors have lately been given powers to issue fresh capital is regarded as assurance that the money will be raised by stock other than Ordinary. Opposition by the Corporation of London to the Great Northern and City's having an extension of time allowed for the railway's further passage into the City was brushed on one side by the Parliamentary Committee, but the shares of the company stay about 2⅜.

Great Northern, Piccadilly and Brompton Ordinary shares are 6½, and the 4 per cent. Debenture stock 86½, the latter being 2 points ahead of similar security in the Charing Cross, Euston and Hampstead Railway. Baker Street and Waterloo 4 per cent. Debenture is 92½. Metropolitan Consolidated drooped to 47, and Districts fell a trifle to 13⅜.

Other traction stocks and shares are but little changed. British Columbia Electric Preferred Ordinary rose a point, and the Preference stock lost an equal amount, the Deferred remaining at 128, although the 7 per cent. dividend was considered good. British Electric Tractions are weaker, and the second Debenture fell two points to 82½. The company makes up its accounts to the end of March and presents them in July. Some cheerful souls look for a dividend on the Ordinary shares. Anglo-Argentine Tramways Ordinary at 7½ are rather easier.

British Thomson-Houston Debenture subsided after its last week's improvement, and London United Tramways Debenture eased off 1 per cent. Potteries Ordinary at 11s. 3d. are 1s. 3d. down.

Except for Edmundson's and Chelsea shares, the electric supply list shows a continuance of its firmer front. Brompton Ordinary are ¼ up, and so are Charing Cross Ordinary, City Preference and Metropolitan Ordinary. Chelseas, however, fell to 3½, though recovering subsequently to 3¾. Edmundson's Ordinary are flat at 30s., and the Preference were at 55s., yet the Debenture stock has risen a point to 90½. The Preference, upon a very small demand, were raised to 3 middle, and it was a matter of some difficulty to buy the shares at all. County of Durham Electric Power Ordinary are now fully paid, and the £5 shares stand at 4¾.

Telegraph issues remain without feature. The Anglo-American group has hardened to a slight extent, but without stimulating business. Direct United States shares at 15s. have lost the 5s. gained by reason of the dividend declaration. There are no other changes in the whole of the telegraph list.

Some demand for Reuters caused the price to harden to 7¾. National Telephone stocks are also a shade better. The first Preference shares at 12½ are the fraction to the good.

Business was done this week in Willans & Robinson Ordinary shares at 32s. 6d., and the 4 per cent. Debenture stock has been marked up to 78—83. Electric Constructions at 7s. 6d. show a small improvement. Callender's lost part of their recent advance, but the manufacturing section, as a whole, is not enjoying sufficient business to cause many price fluctuations in either direction.

Meldrum Bros., Ltd.—The report for 1906 states that, after making full allowance for depreciation of plant, tools and buildings, amounting to over £1,500, due provision for bad or doubtful debts and paying managing directors' salaries, there remains a profit of £2,636, which reduces the debit brought from last balance-sheet to £7,883. Under these circumstances the directors cannot at present recommend the payment of the cum. pref. dividend for the year 1906. The anticipations of large contracts have been fully realised, the orders on the books being now about 50 per cent. higher than at any former period, though they were not received in time to have their full effect on the present balance-sheet. It has been found necessary to considerably extend the foundry, and the extension will be in full work within the next month or two.

Potteries Electric Traction Co., Ltd.—The company's meeting was held on Tuesday. The report was adopted. An amendment reducing the ordinary dividend from 4 to 3 per cent. because of the important question of depreciation, failed to receive a seconder. Our report will appear next week.

Alteration in the Bank Rate.—The Bank Rate was yesterday altered to 4 per cent.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations April 16th.	Closing Quotations April 23rd.	Business done week ended April 23rd, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,252 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	6½.	2½%	3½%	3½%	60 — 63	61 — 64 xd	61½	..	..	6 1 1
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5½%	6 %	6 %	105 —106	106 —107 xd	106½	105½	..	5 12 2
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	½%	1½%	21½ — 22½	21½ — 22½	22⅝	22	..	7 17 4
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6½ — 7½	6½ — 7½	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. St. Red.	Stock	4 %	4 %	4 %	4 %	93 — 95 xd	93 — 95	94⅛	93½	..	4 4 3
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8½ — 8⅝	8½ — 8⅝	..	..	..	5 14 3
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16½ — 17½	16½ — 17⅝	17½	..	..	5 14 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8⅜ — 8⅝ xd	8⅜ — 8⅝	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½ — 9¼ xd	8½ — 9¼	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	3 %	3½%	4½%	..	15 — 15½	14½ — 15½	16	14⅞	+ ¼	5 11 6
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 —142	137 —142	140½	138½	..	4 18 7
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	87 — 89	87½ — 89½	88⅛	87½	+ ½	3 18 3
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	106 —108	106 —108	106⅛	..	..	3 14 1
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½ — 13⅝	13½ — 13⅝	13⅝	13⅜	..	5 1 10
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	..	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	99 —101	..	..	+ ½	3 19 3
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5⅝%	5½%	..	10½ — 11	10⅜ — 11	10⅞	10⅜	..	5 0 0
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13½ — 14½	13½ — 14½	14½	13½	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	35 — 37	35 — 37	36½	..	..	5 6 8
33,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,300, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	18 — 60	58 — 60	..	..	..	5 8 4
356,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	1 15/16 — 2 1/16	1 15/16 — 2 1/16	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107⅞ —109½	108 —110	109½	108½	+ ½	5 9 1
2,225,000	Do. do. Def. Stock	10	5 %	5 %	5 %	5⅛%	104 —106	104½ —106½	106 1/16	104¼	+ ½	5 3 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11¼ — 13½	..	..	+ ⅛	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 8 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅜	..	..	4 8 11
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	96 — 98	96 — 98	..	..	..	3 11 5
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅜	100⅛	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	6½%	7½%	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Stock Certs.	100	..	..	4 %	4 %	95 — 98	95 — 98	96⅛	95½	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
11,838‡	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7¼ — 8¼	7⅞	7 1/16	+ ⅛	4 17 7
60,000	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,167	Submarine Cables Trust	Cert	6 %	6 %	6 %	6 %	125 —128	125 —128 xd	..	..	..	4 13 9
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6¾ — 7¼	6¾ — 7¼	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5¼	5 — 5¼	..	..	..	4 15 3
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 3
15,609‡	West African Telegraph, Shares	10	4 %	4½%	4 %	..	10 — 10½	10 — 10½	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛	13 13/16	13 5/16	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —104	101 —104	..	..	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	7/16 — 9/16	7/16 — 9/16	12/6	11/3	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	..	7½ — 8	7½ — 8	..	..	..	6 5 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	6 — 7	6 — 7	..	..	..	Nil.
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0

Including arrears

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007		..	8 %	8 %	8 %	7 7/16 — 7½ xd	7⅜ — 7⅝ xd	7⅝	7 1/16	..	5 4 11
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5½ — 5⅝	5½ — 5⅝	5⅞	5½	..	4 12 8
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	132 —135	132 —135	..	..	..	4 8 11
286,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	20 %	20 %	20 %	3⅞ — 4⅛	3¾ — 4⅛	80/7½	78/9	..	4 14 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	3 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	5¾ — 5⅞	5¾ — 5⅞	..	..	..	6 1 9
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	..	5⅞ — 6⅛	5⅞ — 6⅛	6 1/16	..	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼ — 5⅝	5¼ — 5⅝	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4½	4 — 4½	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	101 —105	..	..	..	4 15 3
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	126 —130	126 —130	128½	128	..	4 12 4
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	105 —110	106 —111	109¼	106½	+1	4 10 1
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	103 —107	102 —106	..	..	—1	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —101 xd	99 —101 xd	..	..	..	4 8 3
250,000	Do. 4½ % Vancouver Power Debs., 1 to 2,500	100	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 9 1
183,301	British Electric Traction	10	6 %	6 %	3 %	..	3⅝ — 3¾	3 — 3⅛	67/6	60/-	— ⅛	8 11 5
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	7 — 7½	6⅞ — 7¼	7⅛	6 13/16	— ⅛	8 5 6
1,448,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	101 —105	101 —105	104½	103½	..	4 15 3
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	83 — 86	81 — 84	83¼	82½	—2	5 7 2
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾ — 7	6¾ — 7	6	..	..	4 16 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾ — 6¼	5¾ — 6¼	..	..	..	4 6 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 11 10
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	94 — 98	92 — 96	..	..	..	
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
1,016,352	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	65 — 69	65 — 69	..	..	..	5 15 11
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞ — 1 1/16	⅞ — 1 1/16	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	..	⅝ — ¾	⅝ — ¾	..	..	..	5 14 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1 — 1¼	1 — 1⅛	34/4½	..	..	6 17 2
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	3 %	3½ — 4	3½ — 4	76/8	73/9	..	3 15 0
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	5 — 5½	5 — 5½	..	..	..	5 14 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 12 11
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
105,000	Calcutta Trams., 1 to 105,000	5	6 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
82,610	Do. 105,001 to 187,610	5	..	..	8 %	8 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 17 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5¼ — 5⅜	5¼ — 5⅜	5 7/8	..	..	4 6 11
260,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —109	..	..	..	4 8 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	..	10⅜ — 11⅜	10⅜ — 11⅜	10⅝	..	..	6 7 8
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 8 4
491,223	Cape E. Trams., 1 to 491,223	1	10 %	6 %	Nil	..	7/16 — 9/16	7/16 — 9/16	9/9	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	..	1 1/16 — 1 3/16	1 1/16 — 1 3/16	25/-	..	..	4 11 5
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	75 — 77	75 — 77	78	76⅝	..	5 3 11
544,216	Do. do. 4 % Pref. Stock ..	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93⅛	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	56 — 59	57 — 60	57	..	+1	6 13 4
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	2½%	41 — 43	41 — 43	42⅛	..	..	4 18 10
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1⅞ — 2⅛	1⅞ — 2⅛	37/6	..	..	3 10 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations April 16th.	Closing Quotations April 23rd.	Business done week ended April 23rd, 1907.		Rise + or Fall—	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1¼ — 1⅝	1¼ — 1⅝	..	..	..	6 13 4
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	..	1 3/32 — 1 3/32 xd	1 3/32 — 1 3/32	..	..	..	4 19 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6 %	..	14¼ — 15½	14¼ — 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13½ — 14½	13½ — 14½	..	..	..	3 18 8
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,361	5	Nil	2½%	4½%	..	1⅛ — 1⅜	1¼ — 1⅜	22/6	..	..	9 3 9
17,189	Do. "A" shares, 01—017,189 ..	5	Nil	2½%	4½%	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	88 — 92 xd	89 — 92	..	..	..	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	1 7/16 — 1 7/8	1 7/16 — 1 7/8	..	..	+ 1/32	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1¾ — 2	1¾ — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	..	..	..	4 15 3
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8⅞ — 9⅜	8⅞ — 9⅜	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	4 %	92 — 95 xd	92 — 95	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2½ — 3	2⅝ — 3	..	..	..	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	12 — 13	12 — 13	12 7/16	..	..	5 15 5
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5½ — 5⅝	5½ — 5⅝	..	..	..	3 15 7
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	15⅝	..	..	6 3 1
37,500	†Liverpool Overhead Railway, Ord.	10	18%	12%	Nil	Nil	1¼ — 1½	1¼ — 1⅜	..	..	+ 1/8	Nil
10,000	† Do. do. Pref. £10 paid ..	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007	10	8 %	6 %	8 %	3 %	7 — 8	7 — 8	..	..	..	3 15 6
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	8 %	3 %	7 — 7¼	7 — 7¼	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 3
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	85 — 90	84 — 89	86¾	..	—1	4 9 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	3/32 — 3/16	3/32 — 3/16	..	..	..	Nil
600,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 — 3/16	3/32 — 3/16	..	..	..	5 3 11
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	97 —100	96 — 99	..	..	—1	4 10 11
80,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4 1/16 — 4 3/16 xd	4 — 4¼ xd	..	..	..	7 10 0
245,500	Potteries E. Tro.	1	5 %	5 %	4 %	4 %	3/32 — 3/16	1/16 — 1/8	..	..	— 1/16	5 16 4
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 — 3/16	1/16 — 1/8	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98½ —101½	98½ —101½	..	..	..	4 8 8
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	29 — 31	29 — 31	30⅝	29⅞	..	5 15 5
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	5 %	5 %	5 %	76 — 79	76 — 79	78½	78	..	6 6 7
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1¼ — 1⅜	1¼ — 1⅜	32/6	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¼ — 4¼	3¼ — 4¼	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 82	79 — 83	81	..	+1½	4 16 5

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜ — 5¼ xd	4⅜ — 5¼	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7½ — 8¼	7½ — 8¼	7 15/16	..	+ 1/4	5 17 8
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
60,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	5 %	5 %	3 — 4	3½ — 4¼	..	..	+ ¼	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4¼	4 — 4¼	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	4 14 9
175,000‡	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	105¼	104¾	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	10 — 11	9⅞ — 10⅝	..	..	— ⅛	5 11 7
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11 — 12	11⅛ — 12⅛	..	..	+ ⅛	4 18 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£8 7 0	4 %	4 %	3⅜ — 4 xd	4⅛ — 5	..	..	+1	4 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4⅜ — 5 xd	4⅜ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	10⅝	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	1⅜ — 2⅛	1 — 2	..	..	— ⅛	10 0 0
80,000	Do. do. 6 % Cum. Pref... ..	5	6 %	6 %	6 %	..	3 — 4	2½ — 3⅛	..	..	— ⅛	8 11 5
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	88 — 91	89 — 92	90	..	+1	4 17 10
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞ — 5⅜ xd	4⅞ — 5⅜ xd	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5⅛ xd	5 — 5⅛ xd	..	..	..	4 15 3
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7 — 7½	7 — 7⅜ xd	..	..	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	12%	12 %	10 %	10 %	8½ — 9⅛	8½ — 9⅛	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	5	..	..	5 14 3
874,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	5⅜ — 6⅜	6 — 7	6⅜	6 3/16	+ ⅛	5 14 4
76,121	Do. 4½ % Cum. Pref. 1—71,106 ..	5	4½%	4½%	4½%	4½%	4⅜ — 5⅜	4⅞ — 5⅜	..	..	..	4 3 9
230,000‡	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	106 —110	106 —110	..	..	..	4 1 10
250,000‡	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	90 — 93	90 — 93	..	..	..	3 15 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ — 7⅜ xd	7⅛ — 7⅜	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6 xd	5 — 6	..	..	..	4 3 4
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 — 13	12 — 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb... ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6¼%	7 %	7 %	7 %	5⅜ — 6½	5⅜ — 6½	..	..	..	5 12 0
50,000	Dc. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	12½%	10 %	7⅜ — 8⅛	7⅜ — 8⅛	8	..	..	5 17 8
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅝ — 7⅜	6⅝ — 7⅜	..	..	..	4 13 4
150,000‡	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	93 — 95	93 — 95	..	..	..	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ — 2⅛	1½ — 2⅛	30/-	..	..	Nil
60,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2⅛ — 2⅜ xd	2⅛ — 2⅜	45/-	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord..	1	Nil	Nil	2½%	2½%	3/32 — 1/8	3/32 — 1/8	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref... ..	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103 xd	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	2 — 3 xd	2 — 3	..	..	..	8 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	3 — 4	3 — 4	65/-	63/3	..	6 5 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	18 %	12 %	9 — 10	9 — 10	9 3/32	9⅛	..	6 0 0
81,279	Do do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	3 18 3
	(Originally 5%— Red. to 4½ % from 31st Dec., 1905.											

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1⅛. Pref. 70—72 — 1⅛.
† Unless otherwise stated all shares are fully paid. ‡ Interim dividends.

Bank rate of discount 4½ per cent. April 11th, 1907.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1907.

The past month's returns of electrical export and import business show considerable improvement over the preceding month.

The exports for the month of March reached the respectable total of £160,448, a figure which compares with £144,571 recorded in February, and which exceeds the average obtaining in 1906 by some £26,000.

The imports reached the highest point so far recorded in these tables, totalling £173,807. This compares with £146,834 in the preceding month, and also represents some £26,000 advance on the 1906 average.

The re-exports, on the other hand, have again fallen, from £13,215 in February to £10,023 in the month under consideration, and are below the average value recorded during last year.

The figures, as a whole, are by far the best recorded this year, and maintain the favourable position which our returns have indicated in recent months.

Compared with the previous month, the individual items are generally improved. Cable imports are slightly lower; and electrical machinery, &c., exports at £67,000 show a great advance.

As regards the imports, cables show slightly increased value machinery, as in the case of the exports, increased largely to £63,000 in value; and telephonic material (from Belgium and Sweden), represents some £5,000 more than in February.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.*

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material, and electric bells.	Electrically-driven machinery	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	274	...	85	43	112	2,207	...	...	...	41	...
Danish West Indies	...	...	12	...	48	...	...	...	...	...	...
Germany	159	3,816	29	66	38	800	...	...	33	...	...
Netherlands and Dutch Borneo	158	1,416	334	9	3	954	17	...	...	24	...
Belgium	472	169	237	2	286	116	...	8	804	110	...
France	314	...	15	2	...	814	...	...	80	196	...
Portugal, Madeira, Azores and Portuguese Africa	385	12	122	131	3	682	...	...	230	...	...
Spain and Canary Isles	53	...	140	8	134	2,672	16	...	4	...	...
Italy and Austria-Hungary	27	...	212	...	10	4,064	...	...	190	...	...
Greece, Roumania and Turkey	44	...	...	...	...	18	...	...	...	...	...
Egypt	915	884	46	...	20	307	9	100	52	610	...
China and Siam	902	137	511	29	...	554	100	17	372	314	...
Japan	...	7,810	154	...	1,701	3,175	...	...	136	3,895	...
U.S.A., Philippines and Cuba	...	...	35	260	140	547	40	18	...	...	...
Mexico, Colombia, Ecuador, Venezuela & Uruguay	418	1,260	...	226	85	2,179	...	1	...	68	...
Chili	508	491	25	443	132	147	10	104	372	1,631	...
Brazil	2,106	735	49	293	2	3,304	36	...	134	121	...
Argentine	2,210	2,337	252	204	389	2,549	1,629	18	...	...	...
Channel Isles, Gibraltar and Malta	129	91	101	853	...	289	...	...	...	345	...
British West Africa	52	29	...	...	...	247	...	...	...	...	...
Cape of Good Hope	736	1,365	104	72	34	2,742	585	...	19	1,056	...
Natal	1,115	647	947	325	133	1,817	23	5	156	44	...
Zanzibar, Brit. East Africa, Mauritus and Aden	...	337	275	38	7	2,286	13	12	15	38	...
India	1,011	9,932	1,119	1,119	539	11,999	199	101	193	938	774
Burmah	28	743	113	...	...	316	...	35	...	46	...
Ceylon	41	293	10	2	30	19	5	...	31	35	...
Straits Settlements, Fed. Malay States & Labuan	425	331	308	163	60	299	3	40	...	74	...
Hong Kong	27	1,059	539	57	2	46	32	...	9	6	...
West Australia	446	930	228	88	...	285	593	...	...	...	...
South Australia	3,687	118	150	...	...	4,508	32	...	...	...	...
Victoria	96	6,849	857	189	114	1,657	14	...	...	...	...
New South Wales	1,770	968	368	743	52	3,769	30	35	...	312	...
Queensland	129	8	...	99	...	400	...	37	...	105	...
Tasmania	...	...	...	13	...	...	...	...	...	...	...
New Zealand and Fiji	381	4,856	687	148	6	1,395	136	14	13	...	362
Canada	379	...	57	37	6	12	...	...	21	22	...
British West Indies and British Guiana	93	...	3	...	12	170	...	...	8	...	...
Total, £	19,490	47,623	8,124	5,662	4,098	57,345	3,522	545	2,872	10,031	1,136

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Russia, Norway, Sweden and Denmark	6	256	...	25	...	2,082	15	...	10,002	...	...
Germany	2,324	24,834	999	1,535	256	29,588	194	1,013	1,842	3	...
Holland	823	6,037	2,661	6,951	157	3,518	221	6,505	570	...	...
Belgium	882	5,790	1,082	2,112	441	4,833	303	973	10,175	...	...
France	474	5,811	2,691	753	451	1,979	1,773	3,668	27	22	...
Italy and Austria-Hungary	...	40	...	...	...	5	...	52	180	...	...
United States	2,817	1,406	1,224	79	...	18,450	56	396	15	2,430	...
Total, £	7,326	44,174	8,657	11,455	1,305	60,455	2,562	12,607	22,811	2,455	...

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	2,381	...	43	161	17	2,349	...	29	5,023	20	...

Total Exports: £160,448

Total Re-Exports: £10,023

Total Imports: £173,807

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

* This section does not include telegraph cables and apparatus.

PROCEEDINGS OF INSTITUTIONS.

Electric Wave Propagation.

By J. E. Taylor.

(*Paper read before the* Institution of Post Office Electrical Engineers (Metropolitan Centre), *January 11th*, 1907.)

(*Continued from page* 662.)

Production of Magnetic Fields.—In order to simplify matters, the magnetic field has so far been left out of the question, but it will, of course, be understood that any lateral motion, be it expansion, redistribution or wave guidance of lines of strain, gives rise to a magnetic field of force whose intensity or strength is proportional to the lateral velocity of the strain, and whose direction is at right-angles both to the lines of strain and to the direction of their translation. The energy necessary for its formation is derived from the energy of strain which is, of course, proportionately weakened by the abstraction. When such lateral motion takes place with the speed of light, *i.e.*, with the speed of translation of energy proper to the ether, the total energy of such a wave is half energy of strain and half energy of the magnetic field. This corresponds to half the energy being potential and half kinetic, both being in the same phase—a characteristic of all free wave propagation.

Characteristics of Free Waves in Ether.—It becomes easy at this stage to form a physical conception of a free electric wave in space, such as those generated by a Hertzian oscillator. Primarily it consists of a wave disturbance travelling through the ether with the velocity of light, just as a sound wave is a disturbance or translation of energy through the air, but with some differences in detail. By a free electric wave is meant an ether wave consisting of co-existent equal electric and magnetic fields existing apart from and entirely independent of any conducting bodies, the connection with the source of disturbance being completely severed. In order that the magnetic field may be co-existent with and of equal energy to the electric, it is necessary that the latter should have a lateral motion of translation with the velocity of light. If such a wave were brought slowly to rest, it would lose these characteristics and become a simple electric or magnetic field. Given suitable conditions, it would oscillate between the two states from a fixed position, that is, it would not travel, and the energy as a whole would not be translated through the medium in any given direction. An oscillation of this kind would constitute a new source of waves which would travel out radially from the centre of oscillation. In general, the stoppage of a wave converts it into an oscillation. It is necessary to emphasise the distinction between a wave and an oscillation, as the two effects are very often confounded. A true electric oscillation consists of a harmonic alternation of energy between the electric and magnetic states, the two being 90° out of phase, and having zero velocity of translation in any given direction. A true electric wave consists of electric and magnetic fields of equal energy in exact phase with one another, and having the velocity of translation proper to the medium in which it exists.

Condenser Oscillations.—To produce free electric waves, it is necessary to set up a suitable oscillatory electric effect in a circuit or along conductors.

The oscillations are obtained by condenser discharges, and it will be instructive at this stage to follow out the further development of such discharges in the circuit (fig. 14).

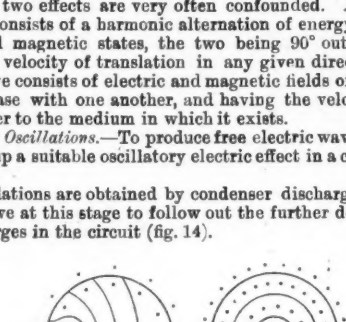


Fig. 14.

The first effect, on completing the circuit, is that the lines of strain held between the plates of the charged condenser expand laterally and spread across the circuit, the ends of the lines being guided by the conductor. This creates a magnetic field which encircles the conductor at all parts, shown in section in the diagram as dots. The expansion on reaching the limits of the circuit is arrested, and a reflection results in which the lines of strain become reversed. Interference between the outgoing and reflected fields now results, and the electric field is annulled. Not so the magnetic, however, as the direction in both the outgoing and reflected fields is the same. Hence the second stage of the process is the growth and establishment of a magnetic field which reaches a maximum just when the condenser is completely discharged and the outward flow has ceased. Were this magnetic field at any instant absolutely devoid of lateral motion, as would be the case if the circuit were perfectly conducting, the lines of strain would have disappeared completely. A consequence of the imperfect conductivity, however, is that the magnetic field shrinks upon the conductor continuously with dissipation of energy therein. This shrinkage generates a weak electric field at right angles to the direction of motion, so that a small number of self-closed lines of strain parallel to the conductor are called into existence, as shown at *b* in the figure. In the case under consideration, however, this factor is of no concern so far as the functioning of the circuit is concerned, but it appears worth mentioning in view of the fact that it has sometimes been assumed that where rapidly oscillating circuits are concerned this condition does not arise, and that the lines of strain terminate on the conductor throughout the whole series of operations. The next stage in the sequence of events is that the condenser having ceased to impress its lines on the circuit it becomes merely a gap in the circuit, and the shrinkage of the magnetic lines, being no longer opposed by the charge in the condenser, becomes rapid, the self-closed lines of strain become stronger, and those in contiguity to the surface of the conductor are passed on by the process of fusion to the gap in the circuit, that is, to the condenser, which now becomes charged up again but in opposite sense. A similar cycle of operations goes on repeating itself until the energy is dissipated by imperfect conductivity. Such a circuit does not radiate its energy, for reasons which will presently appear.

The Hertz Radiator.—If instead of a condenser discharge in a closed circuit, an open radiative system be considered, such as the Hertz dumb-bell radiator (fig. 15), the results are somewhat different.

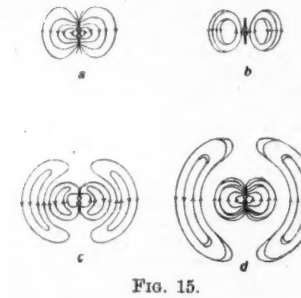


Fig. 15.

Stage one, in which the two parts of the radiator are oppositely charged, is shown at *a*. Immediately a discharging spark bridges the gap the lines of strain move laterally towards the centre. The motion commences first at the conductor, and the result is that a proportion of the lines become detached curves by reason of fusion together of the ends. When this process is complete no lines of strain terminate on the conductor. It is surrounded by the magnetic field (not shown in the figure) created by the motion of the lines of strain. The next process consists in the shrinkage of the magnetic field upon the conductors and the re-connecting of some portion of the previously detached lines of strain to the conductors, as at *c*, and it is at this stage that the real detachment of the wave occurs on the outer parts of the field. Some portion of the lines first detached return to the conductors, and the remaining portion form self-closed lines which radiate into space together with the co-existent magnetic field which takes the shape of expanding circles embracing the whole system. In some of the figures it will be noticed that the lines of strain are shown as forking off into two lines. This is intended to illustrate the fact that the forking lines are of greater intensity than the single parts. It must not be taken that a double resultant force at a point is indicated, but merely that since the velocity of lateral translation is different at different parts of the same line, there must exist a corresponding difference in intensity. It will be seen that motions of a very complex character take place in the neighbourhood of the oscillator. The near parts of the field may have an inward motion, whilst the further parts have a uniform motion outwards. Briefly summarised, all this means that at the oscillator itself a true oscillation occurs with zero velocity of translation, whilst at a radial distance, which is approximately one-quarter wave length from the centre, a true wave is formed having a maximum velocity of translation, outwards. Between these two points the oscillation is gradually merging into the wave.

Relation of Wave-Length to Frequency.—It is hardly necessary to state the relation which exists between wave-length and frequency of oscillation, but as it is important that there should be no indefiniteness on the point, it may as well be given. Wave-lengths are computed on the assumption that free electric waves in air are concerned having a velocity of 186,000 miles per second. This velocity being the same for all waves, it follows that oscillations of high frequency will give rise to shorter waves than low-frequency oscillations, because if the oscillations persisted for one second the waves from each source would have travelled the same distance, but there would, of course, be more waves generated in the high-frequency case in that time, so that each individual wave would be shorter. Hence wave-length $= \frac{\text{velocity}}{\text{frequency}}$.

Relation of Wave-Length to Radiating Power.—If an oscillating system is intended to produce powerful radiation it is essential that the wave-length be not too great compared with the dimensions of the system. That this must be so will be seen at once from the fact that waves are only formed at about a quarter wave-length from the source. If that distance is great, only an extremely feeble field of force due to the oscillating system can be produced there, and the wave formed will be correspondingly attenuated. The fact that the intensity of the field about the oscillator diminishes almost

in proportion to the cube of the distance, whilst the wave intensity only diminishes as the distance, amply explains the matter. In practical wireless telegraphy, however, it is generally advisable to err on the side of producing long rather than short waves, for several reasons, one being that the oscillations are less rapidly damped, and therefore more persistent though weaker, enabling more perfect tuning to be obtained.

Waves Used in Wireless Telegraphy.—It will not be necessary to enlarge on the actions taking place in the field of force surrounding a wireless telegraph transmitter of the vertical wire type, as these differ but slightly from those already described in the case of a Hertzian radiator. The most important difference is in the character of the radiated waves (fig. 16) which, though detached from the

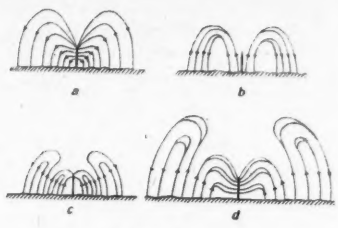


FIG. 16.

vertical wire, remain connected at their lower extremities to the conducting surface of the earth. Like waves produced in metallic circuits they remain adherent to, and are guided by, the conducting surface. On this account they have been variously termed "gliding," "sliding," or "grounded" waves. A preferable description would appear to be "guided" waves.

Appropriation of Wave Energy by Receiving Wire.—To lead up to a proper appreciation of the effects taking place at a receiving installation, it will be necessary to give some attention to the question of interference. It has already been pointed out that when an electric wave is suddenly arrested, the wave becomes an oscillating source by virtue of its loss of translatory motion. The simplest case of this kind to consider is that of two similar wave trains travelling in opposite directions and meeting one another; the electric fields at the fronts will first be annulled, whilst the magnetic are correspondingly increased. As they merge further into one another, the magnetic fields will become annulled and the electric increased. The result is that a group of so-called "stationary waves" are produced by interference. To avoid confusion of terms these will be designated "oscillations." In other words, the medium is thrown into oscillations which become the seat of a new system of waves. Similar oscillations are produced when a conducting mass is encountered by a wave train, and the explanation of the effect is somewhat similar. It is primarily due to interference between the molecular fields in the conductor and the electric field of the wave train. By the process of fusion the conductor is made to throw out an electric field of its own. This increases the interference, and the conductor becomes an oscillating source which radiates waves backwards of the type and with the phase necessary to set up separate oscillations in the medium by interference. If the conductor has the form of a vertical wire, to which the electric field of the advancing wave is parallel, the tendency will be to radiate a new system of waves in all radial directions, forwards as well as backwards; but, as regards the forward direction, the double transformation involved—*i.e.*, waves into oscillations and oscillations again into waves—retards the phase of the waves by 180° compared with the original waves passing the wire. Beyond the wire, therefore, the tendency is to have two sets of waves of the same sign, but in exactly opposite phase. This, of course, results in complete or "destructive" interference and the complete annulment of any form of wave motion in some part of that region, equivalent to a shadow of the vertical wire and its appended electro-magnetic field.

Summarising these effects, it is seen that the vertical wire at a receiving station obstructs the advancing wave primarily in virtue of the molecular fields in its mass, but mainly in virtue of the electric field which the primary action builds up about the wire. It therefore abstracts some portion of the wave-energy from the ether for a certain distance around itself—a most important consideration, without which wireless telegraphy would hardly be practicable. The distance around from which some portion of the energy will be abstracted does not exceed the one-quarter wave-length distance to which the oscillations about the wire are limited. Of the energy abstracted from this region, a portion not exceeding 50 per cent. may be made available for operating the detecting appliance.

It is interesting in this connection to examine the statement usually made concerning the matter, viz., that the magnetic lines of force of the advancing wave cut the vertical receiving conductor and thus generate oscillations. This statement, like most others in which considerations of the relative quantities of energy involved are neglected, is unsatisfactory and incomplete. Seeing that the advancing wave is arrested, and that its velocity of translation therefore becomes zero at the conductor, it follows that the magnetic field ceases to exist at that place because it owes its existence to lateral motion of the lines of strain in the *travelling* wave. There is, therefore, no actual cutting of the conductor by the magnetic lines because they never reach it. At the same time the assumption is often convenient, and is, of course, admissible as a mathematical notion, though it has no real physical meaning.

(To be continued.)

Some Problems in Electric Railway Engineering.

By F. W. Carter, M.A.

(*Abstract of Paper read before the* Rugby Engineering Society.)

The author first deals with the calculation of rheostat resistances for D.C. railway motors, and gives equations by means of which the proper values of the rheostat resistances can be determined for

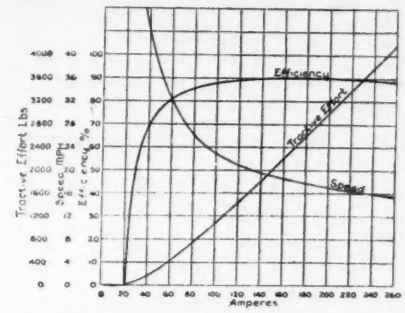


FIG. 1.—Characteristic Curves of Railway Motor at 550 Volts.

series and shunt motors, with a given mean accelerating current and uniform peaks of current. The work of calculation, however, is laborious and tedious, and the author gives curves which enable the results to be obtained in a few minutes; they are not universally

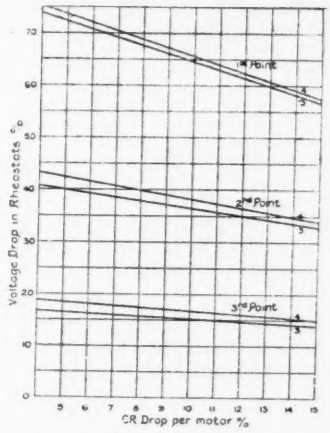


FIG. 2.—Four-Point Series.

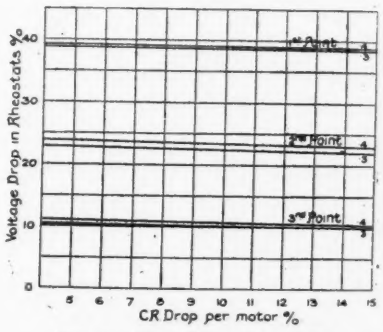


FIG. 3.—Four-Point Parallel.

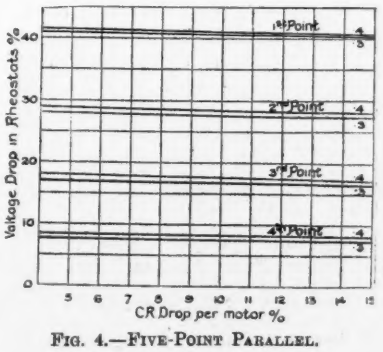


FIG. 4.—Five-Point Parallel.

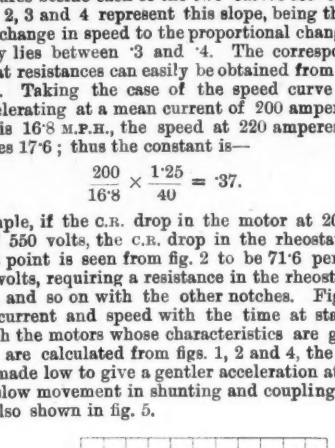
applicable, but apply to any ordinary speed curve, whatever the power of the motor.

Fig. 1 gives the characteristics of a railway motor at 550 volts, and

figs. 2, 3 and 4 show the results of calculations for certain of the more common controllers. The rheostat resistance, so far as it is affected by the shape of the speed curve of the motor, depends upon its slope in the neighbourhood of the accelerating current. The small figures beside each of the two curves for each resistance point in figs. 2, 3 and 4 represent this slope, being the ratio of the proportional change in speed to the proportional change in current, which usually lies between ·3 and ·4. The corresponding values of the rheostat resistances can easily be obtained from the curves by interpolation. Taking the case of the speed curve of fig. 1, for instance, accelerating at a mean current of 200 amperes, where the speed shown is 16·8 M.P.H., the speed at 220 amperes is 16·35, and at 180 amperes 17·6; thus the constant is—

$$\frac{200}{16{\cdot}8} \times \frac{1{\cdot}25}{40} = {\cdot}37.$$

As an example, if the C.R. drop in the motor at 200 amperes is 6 per cent. of 550 volts, the C.R. drop in the rheostat for the first normal series point is seen from fig. 2 to be 71·6 per cent. of 550 volts, or 394 volts, requiring a resistance in the rheostat of 394/200 = 1·97 ohms, and so on with the other notches. Fig. 5 shows the variation of current and speed with the time at starting a train equipped with the motors whose characteristics are given in fig. 1. These curves are calculated from figs. 1, 2 and 4, the first notch in series being made low to give a gentler acceleration at starting, and to facilitate slow movement in shunting and coupling. The loss in rheostats is also shown in fig. 5.



Friction 860 lb. per motor; effective weight, 25·5 tons per motor
total energy lost, ·25-KW. hour approximately.

FIG. 5.—ACCELERATING CURRENT AND RHEOSTAT LOSS PER PAIR OF MOTORS.

The author next explains a method of calculation of energy consumption from dynamical principles. When a speed-time curve for a run with a given train is available, but not the corresponding input to the motors, it is often possible to form a very good estimate of the energy consumption by deducing the output of the motors, and then, from the mean efficiency, obtaining the input. Fig. 6 gives such speed-time and current-time curves for a run of 3,500 ft. on level track, with the motors whose characteristics are

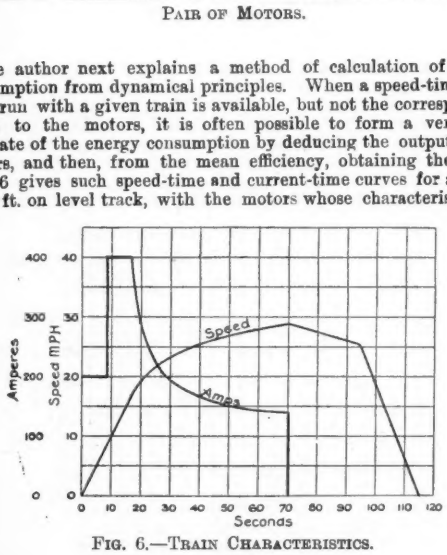


FIG. 6.—TRAIN CHARACTERISTICS.

given in fig. 1. The effective weight of the train is taken, as in fig. 5, at 51 tons per pair of motors, and the train resistance at 720 lb. per pair of motors, the acceleration being made at 200 amperes per motor. The energy consumption for the run, as deduced from the current curve, is 2·27 KW.-hours per pair of motors.

The brakes are applied when a distance of 3,120 ft. has been covered, and the train is running at 25·4 M.P.H. The work done against friction is 720 × 3,120 ft.-lb. = ·846 KW.-hours. The kinetic energy of the train is 51 × 2,240 × 25·4² × 1·467² ÷ 64·4 ft.-lb. = ·930 KW.-hour. The total output of the motors is therefore ·846 + ·930 = 1·776 KW.-hours. This may be divided into two portions, corresponding respectively to acceleration on resistance and speed-curve running.

The distance of acceleration is 207 ft., and the speed at the end 16·8 M.P.H. The work done against friction during acceleration is, therefore, 720 × 207 ft.-lb. = ·056 KW.-hour. The kinetic energy of the train is 51 × 2,240 × 16·8² × 1·467² ÷ 64·4 ft.-lb. = ·405 KW.-hour. Thus the total work done during acceleration is ·056 + ·405 = ·461 KW.-hour. The equipment efficiency during acceleration is usually from 58 per cent. to 60 per cent., so that the input during acceleration is ·461/·59 = ·78 KW.-hour.

The work done during speed-curve running is 1·776 − ·461 = 1·315 KW.-hours. The average efficiency during this period is seen from fig. 1 to be approximately 86·5 per cent. The input is therefore 1·315/·865 = 1·52 KW.-hours.

Thus, the total input is ·78 + 1·52 = 2·30 KW.-hours, which agrees within 1½ per cent. with the figure given above as deduced from the current curve. It will be seen, therefore, that when the conditions of service and characteristics of the motor are known, the method yields results quite comparable with those of direct calculation. It is, however, where the conditions are not fully known that the method is of greatest value, enabling the energy consumption to be computed with fair accuracy from a general knowledge of the service, and of the type of motor employed. Similar methods can often be made use of to obtain the energy loss in the motors, from which the heating can be estimated, and the sufficiency of the motors for the service judged.

Illumination and Some Illuminants.

By JOHN D. MACKENZIE, A.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Glasgow, April 9th*, 1907.)

THE primary object of an illuminant is to give illumination, and illumination is defined as "light used for the purpose of making objects visible."

Although the iris has a very large range of adjustment, its range has limits, and when there is too little light and the iris is open to its fullest extent, our vision gets blurred and dimmed; on the other hand, if the light is too intense, then although the iris may be contracted to its utmost limit there is still an excess of light reaching the retina, and so tiring and overstraining the nerves. Then the eyelids come into play by winking involuntarily.

The paraffin candle gives a yellowish-coloured light with an intrinsic brilliancy of about 3 to 4 C.P. per sq. in.

Acetylene gas has a spectrum very closely approaching that of sunlight, consequently giving a white light whose intrinsic brilliancy is from 75 to 100 C.P. per sq. in.

Incandescent gas gives a spectrum in which green rays tend to predominate, and it has an intrinsic brilliancy of 20 to 40 C.P. per sq. in.

The carbon filament electric incandescent lamp, giving a spectrum in which yellow and orange rays predominate, has an intrinsic brilliancy of from 200 to 300 C.P. per sq. in.

The metallic filament lamps, with a rather whiter light, have an intrinsic brilliancy varying from 400 to 600 C.P. per sq. in.

The Nernst lamp, a whitish light, has an intrinsic brilliancy of bare glower of about 1,000 C.P. per sq. in.

The mercury vapour lamp shows a spectrum without any red rays, chiefly comprising the yellow, blue, violet and green rays, and has an intrinsic brilliancy of about 5 to 10 C.P. per sq. in.

The Moore tube light, with rose or orange tinted light, has an intrinsic brilliancy of about 1 to 1·5 C.P. per sq. in.

All the values given for intrinsic brilliancy are at best only rough approximations.

The intrinsic brilliancy has a most important bearing on illumination, but is often ignored.

Remembering that the eye is attracted to the brightest object in the field of vision, and that the iris adjusts itself to suit the maximum intensity of light emitted by this object, it will be readily seen that the inclusion of an illuminant of high intrinsic brilliancy in the field of vision may cause the iris to contract so far as actually to make surrounding objects almost invisible to the eye.

The usual methods employed to overcome the very apparent fault of too high an intrinsic brilliancy of illuminant are to obscure the lamp bulb, or to enclose the lamp in obscured, opalescent, or prismatic globes, or even to enclose it in shades of fabric such as silk, or of mica, or horn, &c. These substances absorb a very considerable amount of the total light produced in the illuminants. Although this method gives a light-emitting globe of a relatively lower intrinsic brilliancy, still it is at the cost of greatly reducing the efficiency of the lamps.

Reflection is a most useful factor in interior illumination. The light—from the illuminant—which falls on walls, floors, and ceiling is reflected back and forth in an infinite number of rays, each of which tends to increase the actual illumination of the room. The table on p. 701 shows the reflecting values of various substances, and the effect produced in any given case is expressed by the following formula. Let C = C.P. of illuminant; k = coefficient of reflection of surrounding walls, &c.; then total light—

$$L = C\left(\frac{1}{1-k}\right).$$

In an ordinary room under ordinary conditions it is quite possible that the diffuse reflection from walls and ceiling may easily double the illumination due to the illuminant alone.

Our principal aim ought to be the getting of a fairly close imitation of daylight, conforming to some necessary conditions:—

1. The spectrum of the light should approximate to that of daylight.
2. The illuminant must not be anywhere within the usual field of vision.
3. A large degree of diffusion must be obtained.
4. Perfect diffusion must be avoided.
5. Direct reflection of the light must also be avoided.
6. The intensity of the illumination must not exceed a definite amount.

The first condition would place certain illuminants at once out of the field, were we to insist strictly on adherence to it; the eye,

however, can bear a greater amount of yellow and orange-tinted light than it can of any other, and hence illuminants giving off a preponderance of such rays seem to strain the eye less than others.

Only in the very rarest cases is the second condition fulfilled in ordinary domestic illumination. We seem to be hidebound by the traditions born of centuries of use with flame illuminants, which had to be placed at such an altitude as enabled one easily to light or extinguish them. There also seems a very general belief that the indirect method of illumination is most wasteful; but 50 per cent. of the light given by an illuminant is lost in passing through an opal globe, while a whitewashed wall or ceiling will reflect light with a loss of only 20 per cent. In actual practice it will be found that the difference in efficiency of the two methods is not so great as many are inclined to think.

It is certainly necessary to obtain a great degree of diffusion such as we possess in ordinary daylight, but it is just as necessary to avoid perfect diffusion such as takes places with daylight enshrouded in a white fog. Such a state of matters is very trying to the eye, owing to the fact that the light and shade effects are nullified, and hence everything appears so flat that the eye is strained in an endeavour to distinguish the forms of objects.

In this matter of too much diffusion, many of the installations carried out on the indirect method have failed owing to the appearance of flatness obtained by light falling on objects in every direction. In an ordinary room the light comes in through windows placed at one end and, perhaps, on one side, and hence objects in the room appear in light on the side next the source of light and in shadow on the other side. If now the illuminants intended to replace the daylight are grouped more closely about the windows, then a greater effective illumination will be given in one direction than in another.

A very prevalent source of eye strain in offices is the effect of direct reflection from white paper; the illuminants may be shaded from the eye, and yet, owing to the slope of the desk and the angle at which the incident rays strike the paper, reflected rays pass straight to the eye. The source of light ought always in desk lighting to be behind the worker, so that direct reflected rays pass away, instead of towards him.

Unfortunately for our eyesight, and for the eyesight of the rising generation, there seems to be a craze for increased illumination, and the effect is seen in the alarming increase in ophthalmic disease.

In the case of a show window on some business thoroughfare, the object aimed at is to give a brilliant illumination to the goods, and the method familiarised by the Linolite system is on right lines, and eminently satisfactory wherever it has been properly installed.

In domestic lighting it is suggested that high-efficiency lamps, such as the tantalum, should be arranged in straight tubes, backed by reflectors and placed along behind a deep frieze moulding; the principal intensity of illumination to come from one definite direction, preferably from the direction in which daylight enters; the ceiling from which the diffuse reflection is desired to be of a white matt surface, and walls preferably of light tints. These high-efficiency lamps could be arranged in lengths of, say, 12 in., giving four in series on 200 to 250 volts, the total number of lamps being installed according to the highest intensity of illumination desired, and such switching arrangements made as would enable two or more combinations to be made whereby this intensity might be reduced.

TABLE.

Material.	Coefficient of reflection.
Highly-polished silver	0·92
Highly-polished copper	0·60
White blotting paper	0·82
Chrome yellow paper	0·62
Plain deal (clean)	0·45
Light pink paper	0·36
Yellow painted wall (clean)	0·40
Emerald green paper	0·18
Black paper	0·05
Black cloth	0·012
Black velvet	0·004

TARIFFS FOR ELECTRIC MOTIVE POWER.

By A. C. HANSON.

Of the making of tariffs there is no end, as Solomon would probably have said if he had lived in these days of tariff reformers and electric motors. It is not, however, of Chamberlain and fair trade that I would discourse, but of Hopkinson and fair charges. As we have no Solomon with us now to fix a universal, equitable, popular, and remunerative tariff for motive power supply, each station engineer has to do his best to fix such a rate as will please both his consumers and the finance department, and in this attempt the modern Solomon often succeeds only in cutting the baby profit in half, and pleases neither of the interested parties. As a result of all this individual effort, we see extraordinary variations in the methods of charging—from the flat rate of 1d. per unit for all energy, however and whenever it is demanded, to the "time-switch" devices, and the various charges based on the maximum demand.

I should here premise that I, personally, am not a believer in the altruistic doctrine that the alpha and omega of tariffs is to make an equal profit from each and every consumer. At heart, every station engineer would like to make as big a profit as possible from all his customers, without troubling as to whether A is paying more than his fair share, and B less. I use the word "profit" in a broad sense. I am quite willing to supply A at a loss, if, by doing so, I can secure the rest of the alphabet as remunerative customers. Also the profit must be limited so that, at the rate charged, the supply is as cheap as, or cheaper than, possible alternatives. All tariffs which compare favourably with the cost of other methods of driving are fair in my theory; the gas managers, steam engine builders, and others will take care that we don't charge too much; 3d. per unit might be a very modest charge in a town—and there still are such towns—where gas is 5s. per 1,000 cb. ft.

If the above theory is accepted—indeed, whether it be or not—it will be of interest to examine a few of the methods of charging for electrical energy used for motive power purposes.

Dealing first with the unrestricted supply at a flat rate of 1d. per unit, I have yet to see a sound defence of this rate. There may be a few stations that can make a profit on such a charge; but I am confident that most of those that have adopted it—notable examples are to be found within the metropolitan area—are losing money on their power supply. These authorities appear to reverse the theory enunciated above, and are prepared to lose money on the whole alphabet from B onwards in order to secure a profitable customer in A.

There is much to be said in favour of the "restricted hour" tariff, as it is possible to make a profit on a very low charge, when the supply is a strictly "non-peak" one. At the same time, such a tariff in this simple form can only be an alternative; no station engineer could supply on this basis alone, although, as an alternative, it may be a very useful way of at least catching a customer. It must be remembered that in most manufactures the cost of power is an item of secondary importance; and, in my experience, I have found few power users who are willing to have their supply cut off at 4 p.m. during three months of the year, even if during the rest of the year they obtain their energy at some fraction of a penny per unit.

A variation on the above system of charging, and one which is sometimes used as the sole tariff, is that of charging a high rate during "peak" hours and a low rate at other times. To be remunerative, however, the peak charge must be very high; in most cases it would be of the order of 6d. per unit, and the mention of a charge of this sort has a very discouraging effect on would-be consumers. If the peak rate is not high the low rate cannot be very low, and the system had better be abandoned. The theory of this method of charging is excellent, but having the blessed word competition ever before us, we must remember that gas engine costs are no more on Christmas Eve than they are on April 1st. It is always very difficult to persuade a consumer that the comparatively few "high rate" units he uses will only raise his average price by, perhaps, one-tenth of a penny.

Coming next to the maximum demand system of charging, we find a considerable number of towns where this method—in one form or other—is adopted; though it is a significant fact that frequently this system is coupled with a flat rate or sliding scale charge. Whether the tariff is made up by making a fixed charge per kilowatt per annum of maximum demand and a flat rate for all units consumed, or on the system more usually adopted for lighting, *i.e.*, a high rate per unit for so many hours per annum, and a low rate for all additional units, is not a matter of great importance; although I think the former method is the better, if only as being more easily understood. Any maximum demand system, however, is open to the grave objection that it does not take the time of occurrence of the demand into account. In the cases of lighting customers, this time is fixed, in the great majority of cases, by the habits of the sun; and is

approximately the same for all the consumers in a town. The occurrence of the maximum demand of the power-user is not fixed by any such law of nature, and may occur during any hour of the 24. Thus "happy, undeserving A," whose maximum demand occurs at 5 p.m. all the year round, is charged at a lower rate than "wretched, meritorious B," whose works close at 4 p.m. during the winter. And this, as that eminent engineer Euclid would have said, is absurd. The large diversity factor consequent on the unstable equilibrium of the motor users' demand, is usually allowed for by making the fixed charge per KW., or the charge per unit on the high rate, considerably lower than in the case of the lighting consumer; but when one has gone as far as this, I think it is better to go a step further, and to abolish entirely the maximum demand system for power-users.

To digress, there is an advantage obtained by using the maximum demand system of charging for lighting consumers especially, that I have never seen mentioned. This advantage is that when such a system of charging is in use, the accuracy of the meter is of much less importance than when a flat rate has been adopted. A 4 per cent. error in the meter of a consumer charged at 7d. and 1d. on the maximum demand system, is no worse than a 1 per cent. error when the charge is at a flat rate of 4d. per unit.

Revenons à nos moutons—our last "sheep," is the sliding scale, independent of the demand; and this system, in a more aggravated form than usual, is the one I have adopted, with the "restricted hour" tariff as an alternative. I do not claim by any means that this system is a scientific one, but I do find that I obtain a good price from those consumers for whom electric motors are the only possible prime-movers, and that I can compete in price in other cases, where a gas engine is a probable alternative.

The actual scale which will shortly be in use in Stirling is as follows :—

4d.	per unit	for the	first	50	units per quarter
3d.	,,	,,	next	50	,, ,,
1¾d.	,,	,,	,,	400	,, ,,
1½d.	,,	,,	,,	500	,, ,,
1¼d.	,,	,,	,,	1,000	,, ,,
1d.	,,	,,	all over	2,000	,, ,,

In this town, and I am sure in many others, there are connected to the mains a large number of motors of ¼ H.P. and ½ H.P.—used by butchers, barbers, *et hoc genus omne*—which consume about 50 or 60 units per quarter, and run more during the hours of darkness than during the day. Such motors cannot be replaced by gas engines, and even at 4d. per unit, the cost of power is very small. At, say, 1½d. per unit, these motors would be unprofitable customers; their accounts would hardly be worth collecting, and one would be driven to exact the statutory minimum of 13s. 4d. per quarter. It is curious to observe the aggravating effect of a minimum charge; a butcher, for example, who will quietly, almost gladly, pay 15s. for 30 units at 6d. per unit, will object most strongly to paying 13s. 4d. made up of 30 units at 1½d., plus 9s. 7d. "to balance of minimum charge." Why this should be so I am not philosopher enough to be able to say, but I have found it to be the case.

Motors on lifts are not the most desirable of customers, although if enough of them are connected to the mains, they—like tramway motors—"smooth out" fairly well. In Stirling, there are only some half-dozen of such motors, and they sometimes make themselves felt in a somewhat violent manner. Perhaps a fair average of their consumptions would be 150 units per lift per quarter, and this, on the above tariff, works out at approximately 2¼d. per unit. Considering the competition of the hydraulic lift, this is about as much as one can get, at least in Stirling, where the ordinary water supply is at a very high pressure.

The 3-H.P. to 5-H.P. motor, driving a small joiners' shop, or similar works, may consume from 1,000 to 2,000 units per quarter; and the prices per unit on these consumptions are respectively about 1¾d. and 1½d.: gas engine competition is not severe below about 5 H.P., and at 2,000 units per quarter, 1½d. is not very difficult to obtain.

Motor users having an aggregate of about 10 H.P. working steadily, may consume from 4,000 to 5,000 units per quarter; and this they will pay for at about 1¼d. per unit. In most towns, this is a good fighting price against a similar gas engine installation.

Where the consumption is considerable, say, 20,000 units per quarter—I am sorry to say I have no such customer on my mains—the regular tariff works out at 1·05d. per unit; but for exceptionally good customers, exceptional terms can always be arranged, in spite of Parliamentary prohibitions of partial treatment.

I do not pretend that the tariff I have adopted is perfect, or universally applicable—the details would, of course, be varied to suit local conditions—but I believe that a sharply graded sliding scale is, in most towns, the best tariff to adopt. It is easy to understand; if properly arranged, will show a profit on a large majority of the consumers connected, and obviates a great deal of grumbling. Finally, I have found a tariff of this sort very useful for obtaining extensions. A customer puts in a 10-H.P. motor to relieve an overloaded gas engine, and uses about 2,000 units per quarter. If he is told that any extension of the electric drive will only cost him 1d. per unit, there is a strong probability that his gas engine will shortly be for sale.

REVIEWS.

Modern Steam Turbines. Edited by Arthur R. Liddell. Vol. I: The Schulz Steam Turbine. London: A. Owen and Co. 1906. Price 5s.

This is a work along the right lines—namely, a fairly brief description of a machine, with numerous diagrams and examples of trials, and curves plotted from statistics gained. If, as the title denotes, a series of similar works is to be issued, each describing a leading type of turbine, the publishers are to be congratulated on the issue.

The turbine described is a double-expansion two-flow machine, and in its general features does not differ very largely from other well-known types of the Parsons genus. The shape of the blades is not very precisely indicated.

An auxiliary reversing gear is attached, which would lead one to suppose the blades to be simply flat rings. An ingenious regulator, managed by intermediate rings with ports in them, situate between the pressure rings, strikes one as a new feature. To what extent the addition to the moving internal parts is beneficial, users only can say.

While recognising the fact that the maker is most intimately acquainted with his own production, we could wish that the work had not so closely followed the diction and general style of that eminently useful, but not always literary, volume, the trade catalogue. The comparison with the Parsons turbine at the end of the book does not strike one as necessary, if a description of the Parsons is to form one of the series.

The frequent use of italics retains the Teutonic flavour of the original manuscript.

Treatise on the Law and Practice relating to Letters Patent for Inventions, with an Appendix of Statutes, International Convention, Rules, Forms and Precedents, Orders, &c. By Robert Frost, B.Sc. (Lond.), Fellow of the Chemical Society, of Lincoln's Inn, Esq., Barrister-at-Law. Third edition. Two vols. 1906. London: Stevens & Haynes. Price 36s.

Fifteen years have passed since the first edition of Mr. Frost's work on our patent laws appeared, and to-day it stands first among text-books on the subject. Some other text-books have deservedly earned a considerable amount of popularity with certain sections of the public, but it is not too much to say that for legal practitioners and others, whose business demands an intimate knowledge of the details of the law of patents and of the practice relating thereto, the standard work to-day is that of Mr. Frost. A new edition is, therefore, most welcome. It had become necessary as, since the second edition appeared, two new Patents Acts have been placed upon the statute book, and have made very considerable changes in the law. By the Act of 1902, it will be remembered, the procedure

at the Patent Office on applications for letters patent is greatly altered by the introduction of a qualified search for anticipations among earlier British patent specifications, and in the second place, the law relating to the grant of compulsory licences has been amended and greatly improved. These—and the Rules issued in consequence of the new legislation—are the main changes with which Mr. Frost has had to deal in this new edition; but, on the other hand, many important points bearing on the old law, which still remains in force, have been decided in the Courts since his second edition appeared, so that, apart from statutory changes, there has been much work of revision to do to bring the treatise up to date. It is needless to discuss so well-known a book in detail; it is sufficient to say that all the work of alteration, enlargement, and revision has been done in a very thorough manner, and so as to supply the public with a wholly reliable text-book.

A word may be said regarding the altered form of the book. It will be noticed that it now consists of two volumes. This would probably have been necessary in any case in view of the enlargement of the text, for, omitting indices, tables of cases, &c., the first volume has 530 pages of text, and the second volume 450; but in his preface the author states that he adopted this plan in response to suggestions from both Bench and Bar, and, he adds:—"I have endeavoured to so arrange the text that only one volume will be required during the hearing of a particular matter, whether in Court, the Judicial Committee of the Privy Council, Judge's Chambers, or at the Patent Office; and the table of cases and index will be found in each separate volume." The convenience of such an arrangement will be appreciated at once by practitioners.

Of the 450 pages of Vol. II, 306 are occupied by the appendix, in which are set out all the statutes (showing by the type used what has been repealed and what amendments have been made by the later Acts), the terms of the International Convention, the latest rules of practice, and a great variety of forms and precedents. We note that among the statutes the author includes all the provisions of the Acts of 1883 and 1888 relating to trade-marks, and also the whole text of the Trade Marks Act, 1905, which repeals and replaces most of these provisions; but as this treatise deals only with the law of Patents and not with the law of Trade Marks, which is really a wholly different subject requiring a treatise to itself for adequate discussion, perhaps these statutory provisions might without disadvantage be omitted. This is merely a suggestion for the author's consideration when he prepares a fourth edition. Meanwhile, we thank him for the great care he has shown, and the labour he has expended, in the preparation of this third edition, which we commend to all students of our patent laws.

It is somewhat hard upon Mr. Frost that, almost as soon as he has completed his task of bringing his excellent treatise up to date, Parliament should propose to alter very considerably the law as it was amended in 1902, thus rendering useless a good deal of his labour. If the new proposals become law, however, we doubt not that Mr. Frost will again buckle on his harness, and give the public the benefit of his analysis in a later edition.

High-Frequency Currents: their Production, Physical Properties, Physiological Effects and Therapeutical Uses. By H. Evelyn Crook, M.D. London: Ballière, Tindall & Cox. Price 7s. 6d. net.

Signs are not wanting that medical interest in high-frequency currents is rather on the wane. Reasons for this may be sought in the fact that the employment of these currents has been rather overdone, that they have been egregiously exploited by bathmen, nurses and other unqualified persons, that they have been used even by medical men in a "hit or miss" kind of way on the "off chance" rather than on a definite expectation of good results; in other words, that they have been employed unscientifically and without the guidance of definite principles. Moreover, it must be confessed that their results in practice have proved not a little disappointing.

To collect, collate and condense the scattered literature of the last 10 years, to present the subject from its earliest dawn to its latest developments in clear and orderly array, to form a balanced judgment or keep an open mind on disputed points, to search out and formulate such definite principles as may underlie the rational employment of these currents is obviously no easy task, but it has long been a desideratum. In short, there is room for such a book as this, and the present volume certainly fulfils some of the above-named requirements.

That the author assumes a certain amount of electrical knowledge on the part of the reader, may be inferred from the fact that Lord Kelvin's formula, for continuous and oscillating discharges, is referred to on the second page of the first chapter, and such points as hysteresis and Foucault currents are familiarly spoken of without any word of explanation. Under these circumstances it is a little difficult to account for the pains taken a little later on to explain such elementary matters as, for instance, the difference between a continuous and an alternating current, or the mode of action of the Neef hammer. The physical properties of H.F. currents are discussed under five groups:—Electrostatic phenomena, dynamical phenomena, the phenomena of induction, the phenomena of resonance, and the phenomena of electric osmose, and the usual method and nomenclature (that of d'Arsonval) is followed in describing their medical employment, viz., (1) Derivation; (2) Auto-conduction; (3) Condensation; (4) Local applications. Approaching the question of treatment, the number of diseases "amenable" (that seems to be the word) to the influence of H.F. currents is almost bewildering. The writer, avoiding any semblance of a dogmatic attitude, faithfully transcribes the views of more or less prominent authorities, seldom and hesitatingly adverting to his own opinions or experiences. In this connection it is a matter for regret that quotations are frequently given from authors who recount wonderful cures (in *their* hands, of course) without entering into any detail of the technique of the treatment; that is to say, without giving even the most shadowy hint of *how* to do it. Such communications, omitting as they do the very information that the medical man is thirsting to acquire, either that he himself may "go and do likewise," or at least that he may be able to check the alleged results of others, are absolutely useless, and, indeed, not a little contemptible. Under the guise of a scientific communication it is difficult to see in them anything but the "puff direct," or a thinly-veiled effort to catch the ear of the credulous.

It would be too much to say that the volume under notice opens up any absolutely new ground either in the physics, physiology or therapeutics of the subject; nor will the reader be at all times disposed to agree with the opinions set forth therein. Still it must be welcomed as a painstaking and instructive survey of high-frequency treatment as it presents itself to the medical man at the present time.

Without trying to forecast the future, it certainly seems to the reviewer that high-frequency treatment is still on its trial, and that unless it can "prove itself" and establish a more convincing claim than it can at present to the attainment of direct, definite, demonstrable, curative results, it must be content to recede from any prominent position (if, indeed, it has ever attained such) in the practice of scientific medicine.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

12,175A/06. "Improved means for igniting in internal combustion engines." J. J. H. Sturmey. (Date applied for under Rule 5 of the Patents Rules, 1905, May 25th, 1906). April 10th.

8,138. "Improvements in protected fusible cut-outs." H. H. Berry, E. Skinner and W. J. Markham. April 8th.

8,151. "Improved and adjustable method of fixing lamp shades or reflectors for the electric light." J. Rawlings and R. T. Smith. April 8th.

8,153. "Improvements in motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 8th.

8,163. "Improvements in and relating to mariners' compasses." J. C. Dobbie. April 8th.

8,173. "Improvements in and relating to inductor alternators." J. L. Milton. (Date applied for under Patents Act, 1901, February 12th, 1907, being date of application in United States.) April 8th. (Complete.)

8,176. "Improvements in automatic telephone exchanges." J. E. Kingsbury. (Western Electric Co., United States.) April 8th.

8,183. "Improvements in alternating-current machines." R. D. Mershon. April 8th. (Complete.)

8,190. "Ignition device for combustion engines." B. C. Brazier and B. J. Brazier. April 9th.

8,202. "Attachment to electric lamp stands and bells for winding the flexible cord to any length required." A. C. Harnden. April 9th.

8,206. "Invention to be applied to trams, engines or any machinery that runs on rails, for open and fixed stationary points of rails, or trolley wires or any rails or wires requiring points." B. Graham. April 9th.

8,231. "Improvements in electro-thermostatic switches." W. V. D. Kelley. (Date applied for under Patents Act, 1901, April 19th, 1906, being date of application in United States.) April 9th. (Complete.)

8,240. "Improvements in or relating to incandescent lamps or the like." R. J. B. M. Dambeaux. April 9th.

8,249. "Improved electrical signalling device." J. Boult. April 9th.

8,251. "Improvements in high-power vapour lamps for liquid fuel." O. Helfft. April 9th. (Complete.)

8,255. "Improvements in and relating to electric furnaces." S. Z. de Ferranti. April 9th.

8,267. "Improved double-tariff electricity meter." W. Hamilton and Ferranti, Ltd. April 9th. (Complete.)

8,277. "Improvements in the generation of electric energy." R. Lehmann and H. Plauson. April 9th.

8,284. "Improvements in electric accumulators." M. C. Thiellet and M. J. Denard. (Date applied for under Patents Act, 1901, April 12th, 1906, being date of application in France.) April 9th. (Complete.)

8,285. "Improvements in and relating to insulating supports for the end connections of the winding of dynamo-electric machines." British Thomson-Houston Co., Ltd., and W. F. Dawson. April 9th.

8,286. "Improvements in and relating to the rotating members of dynamo-electric machines." British Thomson-Houston Co., Ltd., and W. F. Dawson. April 9th.

8,287. "Improvements in lightning arresters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 9th.

8,314. "Improvements in portable electric lamps for connecting to electric conductors." R. L. Acland and Brecknell, Munro & Rogers, Ltd. April 10th.

8,359. "Improved electric resistance element." A. J. Boult. (W. Hoskins, United States.) April 10th. (Complete.)

8,364. "Improved receiver for wireless telegraphy." Ges. fur Drahtlose Telegraphie. (Date applied for under Patents Act, 1901, April 10th, 1906, being date of application in Germany.) April 10th. (Complete.)

8,365. "Improvements in electric arc lamps." Johnson & Phillips, Ltd., and C. F. Tubbs. April 10th.

8,373. "Improvements in electric curling irons." J. L. Burgard and H. Bollin. April 10th. (Complete.)

8,376. "Improvements in and relating to electric switches." C. A. Vandervell. April 10th.

8,387. "Improvements in electrical apparatus for manufacturing nitrogen compounds." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 11th.

8,388. "Improvements in systems of lighting by electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 11th.

8,399. "Electric clock system, working in connection with a telephone exchange." B. Brander. April 11th.

8,405. "Electrolytic ozonising, disinfecting and deodorising." R. E. Lennox. April 11th.

8,412. "Device for giving audible or visible signals, or both, on railway locomotives and vehicles." A. W. Willcox. April 11th.

8,433. "Improvements in alternating-current commutating electric machines." M. C. A. Latour. (Date applied for under Patents Act, 1901, April 12th, 1906, being date of application in France.) April 11th. (Complete.)

8,445. "Improvements relating to electric furnaces." The Grondal Kjellin Co., Ltd., and J. Harden. April 11th.

8,462. "Improvements in apparatus for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. April 11th.

8,463. "Improvements in apparatus for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. April 11th.

8,471. "Improvements in electric signalling apparatus for use on railways and the like." N. Kessler and G. Jelich. April 11th.

8,474. "Improvements in electro-mechanical control of hydraulic lifts and like apparatus." R. A. Smith. April 11th. (Complete.)

8,492. "Improvement in voltmeters." P. Watson. April 11th.

8,503. "Method and apparatus for recording or transmitting sound waves." B. Brander. April 12th.

8,504. "Improvements in multiple switch controlling apparatus for electric circuits, specially applicable to motor-starters." P. S. Brook and J. A. Hirst. April 12th.

8,549. "Improvements in and relating to electric fuses." H. J. Herberts. April 12th.

8,555. "Improved means for regulating the supply of electric currents." Societe des Garages Krieger et Brasier. (Date applied for under Patents Act, 1901, April 26th, 1906, being date of application in France.) April 12th. (Complete.)

8,556. "Improvements relating to high-tension ignition apparatus." Societe des Garages Krieger et Brasier. (Date applied for under Patents Act, 1901, April 27th, 1906, being date of application in France.) April 12th. (Complete.)

8,560. "Improved electro-plating solution." R. H. Marshall. April 12th. (Complete.)

8,562. "Improvements in the electro-deposition of zinc." H. Paweck. April 12th.

8,563. "Improved process for the manufacture of metallic illuminating bodies adapted for electric incandescence lamps." Deutsche Gasglühlicht Akt.-Ges. (Auerges.) (Date applied for under Patents Act, 1901, August 30th, 1906, being date of application in Germany.) April 12th. (Complete.)

8,574. "Improvements in means for effecting electrical contacts or connections." W. J. Florence. April 12th.

8,577. "Improvements in and relating to rheostats." Ateliers Thomson-Houston. (Anciens Etablissements Postel-Vinay.) (Date applied for under Patents Act, 1901, April 13th, 1906, being date of application in France.) April 12th. (Complete.)

8,583. "Improved electric lift controller." G. B. Bowell. April 13th.

8,593. "Improvements relating to insulators for high tension electric currents." F. G. Kleinsteuber. April 13th.

8,611. "Improved device for connecting wires to telephone receivers and the like." C. Brunnschweiler. April 13th. (Complete.)

8,612. "Improvements in or connected with electric arc lamps." A. G. Sims and F. Stevenson. April 13th.

8,617. "Improvements in electric switches." J. Miles. April 13th.

8,623. "Improvements in the means of propulsion of electrically-driven trains and the like." S. Stone and L. W. Migotti. April 13th.

8,629. "Improvements in or connected with the utilisation of electrical energy in the case of intermittent or suddenly changing loads." A. H. Human. April 13th.

8,641. "Improvements in joints between incandescent electric lamp filaments and leading-in wires or supports." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 13th.

8,642. "Improvements in mounting incandescent electric lamp filaments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 13th.

EXPIRING PATENTS.

(Continued from page 664.)

15,479. "Electric lamps." L. E. Howard, of New York, U.S.A. August 15th, 1893. Arc lamps. Consists in enclosing the arc in a small transparent heat-resisting envelope for maintaining the gases surrounding the arc in an incandescent condition, whereby the lamp is rendered operative at 25 or 30 volts, and the life of the carbons is much increased. The negative carbon is mounted in a socket forming part of the removable bottom of a cylinder of glass not exceeding 3 in. in diameter. The positive carbon passes through a plug consisting of a non-conducting part, into which screws a metal piece provided with a central hole for the free passage of the carbon. Between the metal piece and a plate is clamped a washer of asbestos, which fits the carbon closely but easily, and practically prevents ingress of air. Escape of gases due to sudden expansion is provided for by a passage over which is a gravity valve fitted with a limiting stop. In another form, the envelope consists of a cylinder fitted with a removable cap at top and bottom, forming airtight joints by means of asbestos washers. In this form also is a negative electrode consisting of a block of carbon mounted on a conducting stem. The upper carbon passes freely through a plug mounted on a cone which may be fitted with a flanged reflector. In one form an auxiliary protecting globe, provided with a hood or reflector formed of two parts, which may be hinged together at one side, is used.

16,175. "Electric fittings." A. P. Lundberg, London. August 28th, 1893. Connecting metal parts to porcelain or other similar substance. A method is described of connecting a switch-bar to a handle. A horizontal hole is drilled, and in it is fixed a wooden or metal bar. Vertical holes are also drilled through which screws may be passed to screw into the metal bar. In a similar manner covers may be secured to bases, blocks being let into slots and screws passed in through suitable holes.

16,307. "Electric meters." J. Swinburne, Middlesex. August 30th, 1893. Quantity and energy meters. A watt-meter for alternating currents consists of a conducting disk mounted on an arbor between two crowns of magnets formed of rolled-up iron strips, in which radial slots are formed for inserting coils, half the magnets being excited by the main current and half by means of a shunt current, the pressure and current magnets being arranged alternately. The action between the field magnets and the induced currents in the disk produces a movement of the latter against the action of a spring. Quantity meters. By removing the spring control and applying a brake, whose torque is proportional to the speed, the instrument is converted into a quantity meter, the speed of which is proportional to the power.

18,019. "Electric switches." J. H. Tucker, Birmingham. September 26th, 1893. The tumbler handle is jointed to the contact bar, which (in one form of switch) is pivoted on a pivoted plate, and normally forced upwards by means of a spring. On moving the handle the end of the contact bar is forced between two contacts to complete the circuit. It is held in this position by the joint which connects the handle to the contact bar, passing slightly beyond the line of pressure. On moving the handle the reverse way the spring forces up the contact rapidly, breaking the circuit. Modifications are described.

18,173. "Electrolysis." J. Hargreaves and T. Bird, both of Lancashire. September 27th, 1893. Relates to apparatus for decomposing chlorides, iodides, bromides, nitrates, sulphates and other salts by electrolysis. Either the cathode or the anode, or both, is exposed or bare, instead of being submerged in the electrolyte. The cell is built up of ends and alternating sections. The anodes are of carbon, serrated or grooved along one surface, or perforated, and the cathodes of wire gauze or perforated metal. Permeable diaphragms are placed against the cathodes and anodes. Compartments are thus formed alternately, separated by other compartments containing the electrolyte, which is charged in through suitable openings.

18,661. "Order Telegraph." F. G. P. Preston, Kent. October 5th, 1893. Ship or other order telegraph for signalling to the engine room, indicating the position of the steering gear, or for working or firing ordnance, torpedoes, &c. A series of magnets are arranged radially round a central portion, in which is mounted a permanent or electro-magnetic armature provided with a pointer. The radial magnets are arranged in opposite pairs, all the pairs but one being doubly wound. Currents are transmitted to any particular pair by means of a contact ring, and a ring of segments connected to each magnet respectively. A connecting brush, bridging between the contact ring and the segments is carried by an arm on an axle. This axle is rotated by means of a handle having a pointer and spring stop.

18,912. "Railway signals." E. Tyer, London. October 9th, 1893. Signalling instruments. Relates to block signalling instruments of the kind in which the plunger attached to a commutator disk passes through a knob or handle that can be partly turned round to set the commutator ready for making contacts, and to one or other of two indicating tablets opposite an aperture. The improvements consist in employing three indicating tablets marked "Train on line," "Line clear," and "Train out of section," and in providing with the instrument a special kind of safety switch.

19,197. "Typewriters." A. Ashby, Reading. October 12th, 1893. Relates to means for indicating when the end of a sheet is nearly reached. A circuit is closed and an alarm sounded when the end of the paper has passed a point at which a finger makes contact.

19,423. "Distributing electricity." M. Dolivo-Dobrowolsky and Allgemeine Elektricitats-Gesellschaft, of Berlin. October 16th, 1893. In the three-wire system with continuous currents a self-induction coil is arranged on the compensating wire to prevent sparking at the point of connection of the wire with the generator. Within the armature of the generator a coil is arranged, its ends being connected with opposite points on the armature. A compensating wire is connected with the coil at its central point. In a modified arrangement the coil is arranged without the armature, and the ends connected to it by brushes. In a different arrangement the wires are connected to an auxiliary generator or motor, the induction coil being arranged as before.

19,809. "Carbon." H. Y. Castner, of London. October 20th, 1893. Relates to the manufacture of carbon electrodes, specially adapted for use in electrolytic processes. Gas retort or similar carbon, in contact with a non-oxidising gas or charcoal, is raised to a high temperature by means of an electric current.

20,069. "Regulating switches." R. Lundell and E. H. Johnson, of New York, U.S.A. October 24th, 1893. Regulating switches for high-tension currents, as for motors for tramcars, &c. The switch is formed with two insulating cylinders of different diameters carried on an axle which is turned by a wheel. A locking device, consisting of a corrugated disk and rollers, is provided for holding the switch in certain positions. The cylinders carry certain conducting pieces adapted to bridge across contact springs arranged adjacent to the cylinders. The contact springs of one set are connected alternately, one set of conducting pieces serving to complete or break the circuit at the several points simultaneously. The contact pieces of the other set are suitably interconnected, and the corresponding contact springs are connected to a resistance, the armatures, and the field magnets. On turning the switch cylinders, the motor is controlled to vary its speed or direction.

20,604. "Aluminium and aluminium compounds." D. A. Peniakoff, of Paris. October 31st, 1893. (Date claimed under Sec. 103 of Patents, &c., Act, 1883, April 5th, 1893.) The process consists essentially in treating bauxite to obtain alumina, converting the alumina into the sulphide, and then extracting the aluminium by electrolysis. Several by-products are also obtained. The bauxite is fused with alkalies, and the aluminate decomposed by carbonic acid, which regenerates the alkali and precipitates pure alumina. The alumina is mixed with sodium or other sulphate, and heated with formation of an aluminate and disengagement of a mixture of sulphurous acid and oxygen, which is utilised for the manufacture of chlorine by passing it over salt, or hydrochloric acid is obtained in the presence of steam. Sulphide of aluminium is obtained by treating alumina or aluminium sulphate by carbon bisulphide. Or preferably the alumina is heated with a sulphide, or sulphur in the state of vapour is passed over a mixture of alumina and a small proportion of a sulphide. Aluminium is obtained from the sulphide by reducing it with a suitable metal, as lead, sodium, &c., or by electrolysis. The sulphide readily dissolves aluminium sulphate, and the mixture is readily electrolysed.

(To be continued.)